The Welding Engineer

Edited by L. B. Mackenzie

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AIRCO DAVIS APPARATUS

ANYTHING AND EVERYTHING
FOR OXYACETYLENE WELDING AND CUTTING

Public faith in a product is a reflection of faithful performance. Thus, consistently, have Airco Oxygen and Airco Acetylene built up good-will.

AIR REDUCTION SALES COMPANY

Manufacturer of Airco Oxygen—Airco Acetylene—Airco-Davis-Bournonville Welding and Cutting Apparatus and Supplies, Acetylene Generators, and Specially Designed Machines for Automatic Welding and Cutting—Nitrogen, Argon and other Airco Atmospheric Gas Products

Controls the manufacture and sale of National Carbide

Home Office: 342 Madison Avenue, New York, N. Y.

Airco District Offices, Plants and Distributing Stations conveniently located throughout the country.

Air Reduction Sales Co. maintains its own Apparatus Repair Shops in Airco District Office cities.

"Airco Oxygen and Acetylene Service is Good Service."

Solving the Riser-Cutting Problem

Not long ago, when the feasibility of producing a casting of unusual size or intricate shape was being considered, the cutting off of risers was a serious factor.

Today the factor is no longer serious—the oxy-acetylene process has solved it—cleanly and economically.

The job above, from a middle-west foundry, is interesting. This one took a little team-work. Note that the cutting operator, working outside, cannot see the line of cut but is being guided by signals from his helper inside the casting.

Many foundries tell us that the oxy-acetylene process has revolutionized methods of manufacture in their plants, and that within a few years, it has greatly broadened their scope of operations.

Thousands of plants and shops are daily expanding their business by intelligent use of oxwelding and cutting. Where machinery is used it is essential maintenance equipment.

Oxweld Resident Engineers in over fifty cities are ready to work on your problems.

OXWELD ACETYLENE COMPANY

Newark, N. J. Chicago San Francisco

Oxweld

WELDING AND CUTTING APPARATUS

World's Largest Manufacturers of Welding and Cutting Equipment

A Fine Feeling of Safety and Satisfaction

Will be yours when you equip your Oxy-Acetylene Regulators with MATTINGLY AUTOMATIC SAFETY VALVES, because they close Instantly and Automatically should the Hose Line become disconnected, ruptured from back-fire or other causes.

Many times Welders are required to do some kind of a job that requires them to get into close places where their Safety, and, in some cases, their lives depend upon the tensile strength of a small hose line. Any time the hose line fails or becomes disconnected personal injuries, loss of time, hose and gas or fires may result. What provision have you now for shutting off the escape of gas from the tank quickly? Mattingly Safety Valves do it INSTANTLY and AUTOMATICALLY. This fact has caused them to find their way into the largest Industrial Plants, Railroad Shops, Navy Yards, etc., in the country.

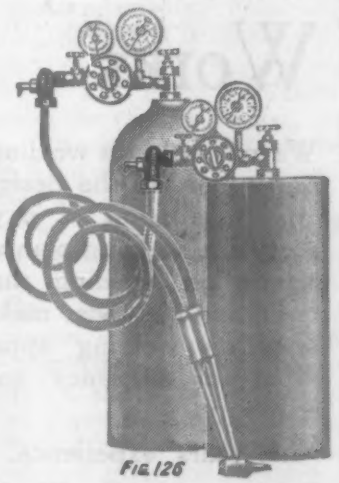

FIG. 126

Patented

These Safety Valves are as easily attached as a piece of hose and complete Instruction for care and operation go with every pair. They do not interfere with the operation of the Torch and work equally well with any make of Regulator. They close only when you want them to and that is when the hose line becomes disconnected or fails from back-fire or other causes.

We back up our claims with ACTION. Do you want this kind of PROTECTION and FINE FEELING OF SAFETY? If so, fill out the attached Coupon and a pair of Valves will be sent you on 30 days' free trial with the understanding that if they do not work as represented and do not afford you needed protection, they are to be returned without obligation on your part. You be the "Judge and Jury." If you can write a fairer proposition, we'll gladly sign it.

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Dealers wanted in all unoccupied territory.

Mattingly Automatic Valve Co.
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Date.....

Gentlemen:

Please ship at once to

Name .....

Address .....

the following.....pair Mattingly Safety Valves for Oxy-Acetylene Welding and Cutting Apparatus. Make of our regulators is..... Size of hose connection to regulator..... We understand that we are to install and use these valves for 30 days before paying for them, and if the valves do not work as represented, we are to return them to you at your expense.

Signed.....

Price $10.00

Per Pair Delivered—U. S. A.

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Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

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See "Torches"

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Nine years' experience.

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Unsurpassed in performance

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PRECISION instruments of special design are used to control and measure the temperatures, pressures, flows, and purities of the gases in determining the fundamentals upon which the design of PUROX torches is based.

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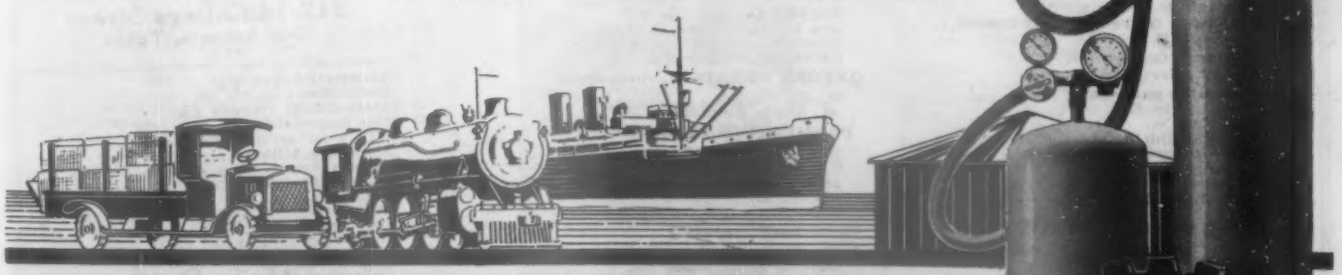
Los Angeles Detroit anses City



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WORLD'S BEST QUALITY—HIGHEST GAS YIELD

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Bare and Flux Coated for Electric Welding

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ALPHABETICAL INDEX TO ADVERTISERS

Amling, H. G. 41
Air Reduction Sales Co. ..... Front Cover
American Carbolite Sales Co. 15
American Welding Society 37

B
Bastian-Blessing Co., The 26-27
Bierman-Everett Fdy. Co. 50
Buffalo Dental Mfg. Co. 19
Burdett Mfg. Co. 10-11

C
Carbic Mfg. Co. ..... Inside Back Cover
Central Steel & Wire Co. 41
Chicago Eye Shield Co. 47
Chicago Steel & Wire Co. 8
Commercial Acetylene Supply Co. 9
Wm. Cramp & Sons 18

D
Davis-Bournonville Co. 50
M. Keith Dunham 45

E
Electric Arc Welding & Cutting Co. ..... Back Cover

F
Federal Brass Works 19

G
Gas Products Assn. 14
Gas Tank Recharging Co. 17
General Electric Co. 25

H
Harris Calorific Co. 19
Hauck Manufacturing Co. 16

I
International Oxygen Co. 50
Imperial Brass Mfg. Co. 50

K
K-G Welding & Cutting Co. 16
Klauer Co. .....

L
Liberty Welding & Mfg. Co. 49
Linde Air Products Co. 20

M
Manganese Steel Forge Co. 49
Mattingly Automatic Valve Co. 3
Alexander Milburn 12
Morey Flux & Chemical Co. 50
Modern Engineering Co. 43

N
National Carbon Co. 50

O
Oxweld Acetylene Co. 2

P
Page Steel & Wire Co. 13
The Prest-O-Lite Co., Inc. 31
The Purox Co. 5

Q
Quasi-Arc Weldtrode Co. 50

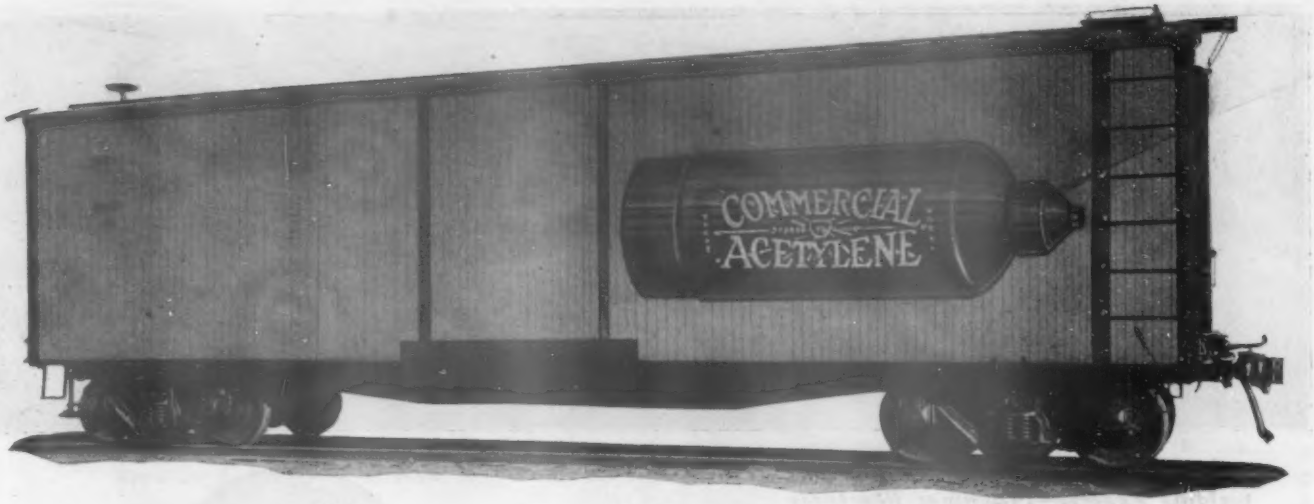
R
Reid-Avery Co. 45
Rochester Welding Works 4
Roebling, John A., Sons Co. 13

S
Sail Mountain Co. 48
C. Sorensen 47
Superior Oxy-Acetylene Machine Co. 49
Southern Welding Machine Co. 6
Shawinigan Products Corporation 18
Smith's Inventions, Inc. 16
Standard Carbide Sales Co., Inc. 37
N. A. Strand & Co. 50

T
Torchweld Equipment Co. 17
Thermalene Gas Corp. 37
Transportation Engineering Corp. 16

U
Union Carbide Sales Co. 7
U. S. Gauge Co. 48
United States Welding Co. 49

W
Welding Metals Mfg. Co. 47
Westinghouse Electric Mfg. Co. 50
Wm. Wharton, Jr., & Co., Inc. 50
Wilson Welder & Metals Co. 43
Wodack Electric Tool Corporation 48



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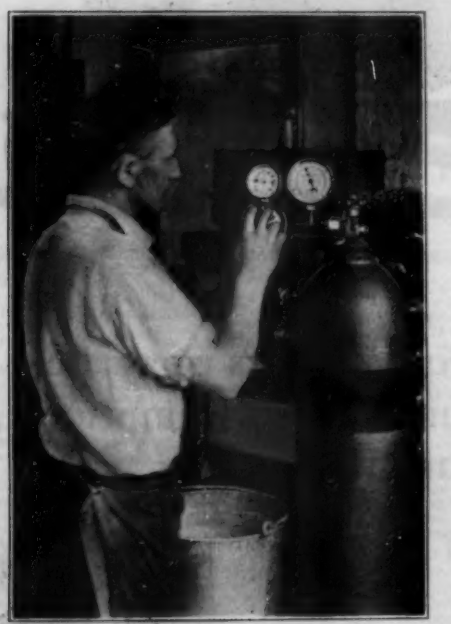
Making BURCO equipment for welding experts—Machines like these take the guess work out of welding torch construction.

The BURCO Oxygen Regulator performs equally well on both welding and cutting—saves the cost of an extra regulator.



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Testing a BURCO TORCH—Thorough mixture, obtained through BURCO construction, is proof against the molten metal bath. BURCO Torches do not flashback nor overheat.

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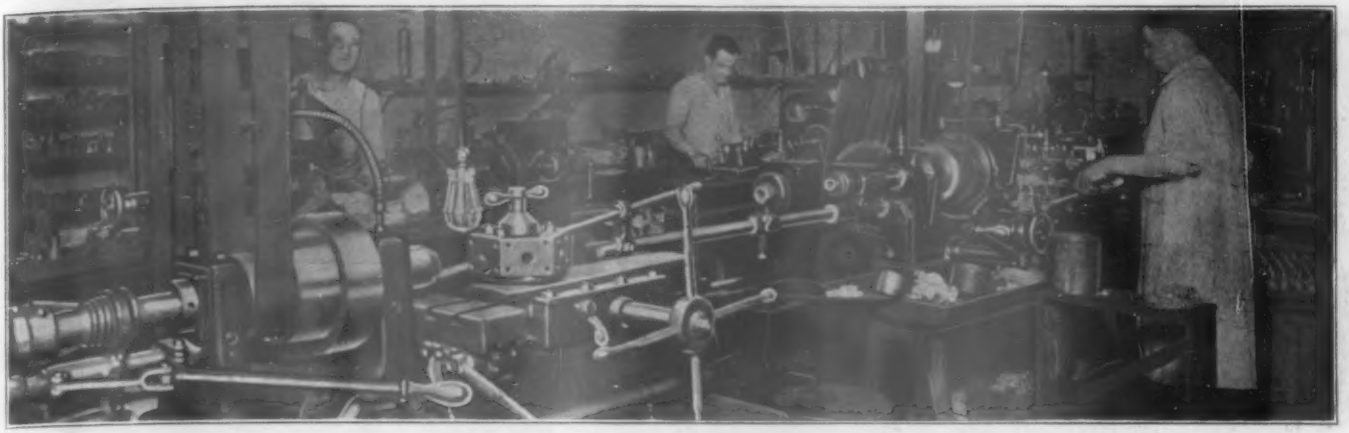
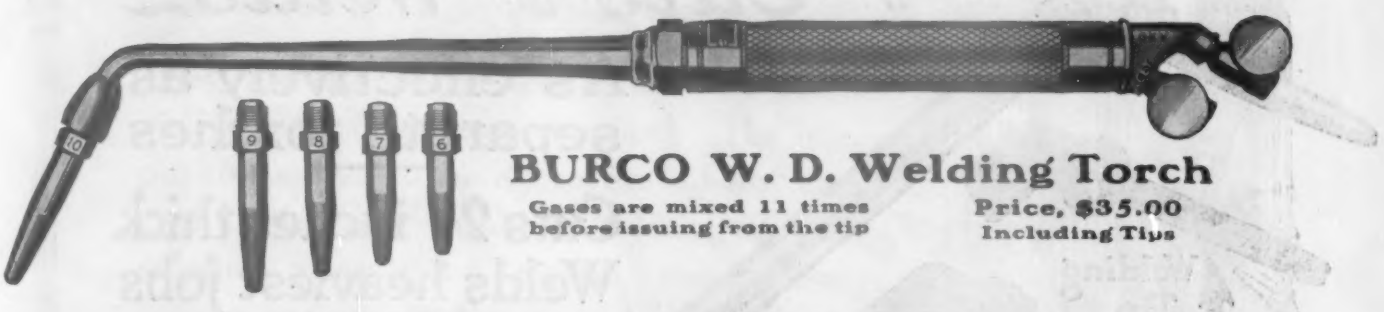


Service is built right into BURCO apparatus as it goes through our factory



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Gases are mixed 11 times before issuing from the tip

Price, $35.00 Including Tips

The Demand for Better Equipment Keeps the BURCO Factory Busy

MAKING torches and regulators for particular welders requires up-to-date production methods, and the BURCO factory has them. These glimpses of our production and testing operations show you what is behind BURCO equipment.

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COMBINATION TORCH

Cuts and Welds

As effectively as separate torches

Cuts 24 inches thick
Welds heaviest jobs

SAVES
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TIME
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YOU MERELY CHANGE THE TIP

Is standard in leading industrials

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WELDING, CUTTING, LEAD AND CARBON BURNING TORCHES OF THE BETTER KIND	30 LB. PORTABLE AND LARGE ACETYLENE GENERATORS	MILBURN GAS REGULATORS HAVE FEWER PARTS SAVE TROUBLE

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INGOT IRON

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There is no explosion chamber in a Smith Welding Tip. A Smith Tip does not splatter hot metal on the welder. The mixing chamber extends from mixing nozzle to tip, eliminating gas pockets, popping and back firing.

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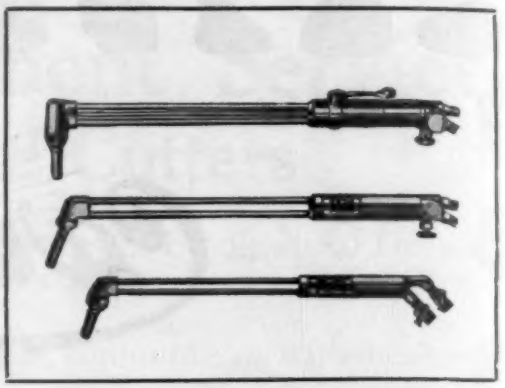
Exclusive Manufacturers of Welding & Cutting Equipment



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COATED WANAMAKER ELECTRODES

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Records for Success and Size of Installations!

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CALCIUM CARBIDE

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For ACETYLENE GENERATORS

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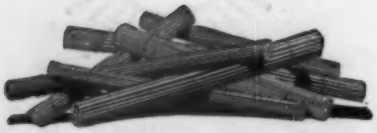
SUN-LITE

Cramp's Welding Rods



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for repairing Scored Cylinders and Water Jackets, etc. Thoroughly tried for several years by our customers and found entirely satisfactory.

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A joint properly made with this solder is stronger than the original casting and is preferable to a welded joint.

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SHAWINIGAN

Roebling Welding Wire

Conforming to Spec. E1B and G1A of The American Welding Society

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Absolutely uniform in quality

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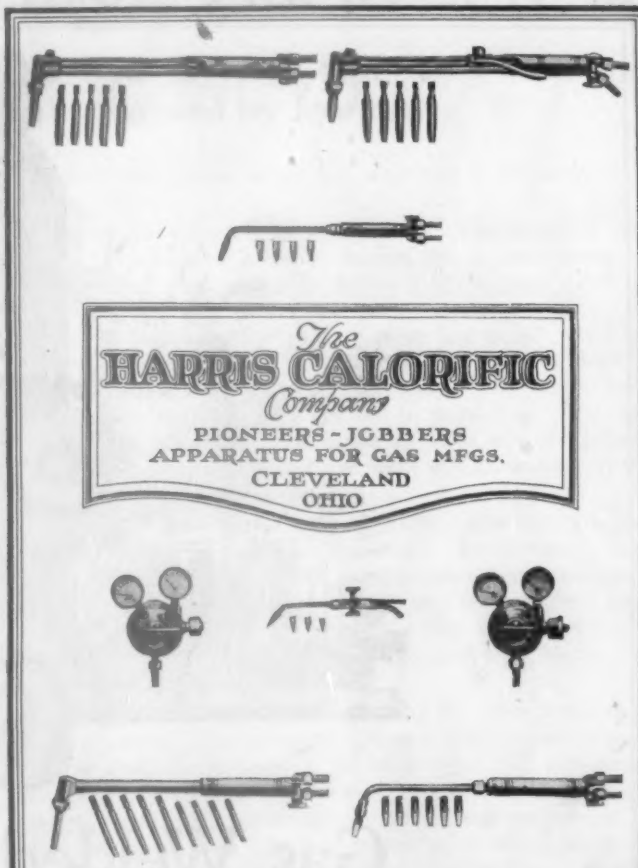

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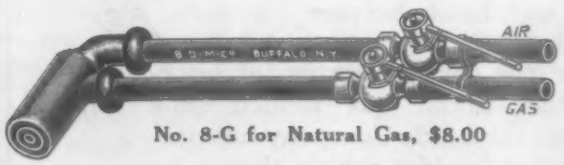

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LINDE OXYGEN

SAFETY IN WELDING PRACTICE*

Precautions to Be Observed in Both Electric and Gas Welding—Accidents Are Usually Caused by Ignorance

SAFETY IN GAS WELDING AND CUTTING

By C. F. Worfolk[2]

A CANVASS of industrial plants reveals the fact that burns resulting from carelessness form the majority of injuries to persons in the oxy-acetylene welding trade.

Injuries to the eyes, due to failure to wear proper goggles are second. The employment of only properly trained men for this work would greatly reduce accidents from these two sources.

Injuries from fires and explosions due to defective apparatus are comparatively few, now, thanks to the many improvements that have been made in appliances. There are some, however, and in most cases they could be prevented. We might class them, in their order of frequency as:

(1) Gas fires. Due to leaky, or defective, or open valves in acetylene tanks. An open valve needs no comment. It is just plain carelessness. The average welder has a tendency to become careless. Perhaps in his case familiarity breeds contempt. He is quite likely to get his torch too close to the tanks or the manifolds. Unless the shop is very well ventilated indeed, any escaping acetylene will lie near its sources and the heat of the torch will ignite it. Such a fire is hard to extinguish. An extinguisher of the "Pyrene" type is no doubt one of the best carbonic acid gas, similar to that used in soda fountains, will means of stopping this blaze, but a tank of carbon dioxide or have such a blaze out very quickly. All welding shops should have a tank of this gas on hand for such emergencies.

(2) Gas explosions. Due mostly to getting a mixture of the gases into a confined space and then igniting it. "Shop" explosions are frequently produced in this way. They are almost invariably due to leaky apparatus or to carelessness.

(3) Tank explosions. These are very rare, as the tanks are built to withstand astounding pressures and in each tank is a safety plug intended to blow out and relieve the pressure before the bursting point is reached. The blowing out of this plug at four or five thousand pounds pressure can be attended with very exciting results. Tank pressures are known to run up to four thousand pounds sometimes. This is not the filled pressure; but with perhaps eighteen hundred or two thousand pounds of gas in the tank it is left in direct sunlight or in a very warm temperature; immediately the pressure begins to mount. These tanks should be stored in a cool place.

(4) Valve explosions. These are likely to occur only with old style apparatus and because the operators has let it get into bad condition. There have been many accidents with old style apparatus, but today most of it is in the discard.

Frequent (and regular) inspections should be made to insure proper condition of apparatus.

The operator is a much more difficult problem to deal with than is the apparatus he handles. He is quite likely to be a green country boy unfamiliar even with the dangers attendant upon the use of ordinary city gas. Somewhere he has seen a workman use a torch and inspired with the belief that he can do equally well he sings a long story to the employment man and gets a job as a "welder." The worst of it is, it *looks* easy. Anyone can turn on a valve and light a torch, no matter how ignorant he may be of the tremendous forces he is setting in motion.

At times industry seems to be woefully short of acetylene welders and the employment man at his wits' ends to secure competent hands grasps at the first straw and so our green hand goes to work.

What does he know of hot or cold metal, of expansion or contraction? How is he going to harness this molten destruction to constructive purposes? He is just a green hand. Perhaps the boss welder gave him a few inadequate instructions. Perhaps all he said was "There's your place, hop to it." He hops. He heats a metal article of some sort and fails to mark it properly. Along comes another workman. The article looks just the same to him cold or hot and he picks it up. The first-aid man now has a nasty burn to fix up. The injured workman is off the job for a few days and there is compensation to pay for his injury and enforced vacation.

Burns form the vast majority of welding injuries. The man who gets burned isn't always the welder. Burns from picking up hot metal that has not been properly marked or safeguarded, lead the list. Chalking the word "hot" onto the metal isn't going to help the man whose only English is "No spik Inglis" unless you tell him very forcibly what it means and train him to look out for it in the welding shop.

A properly trained welder will protect the other fellow from his "hot" metal. The green hand does not know enough to do so. He costs the employer a lot of money. Just because the first aid department handles the burn case it likely gets charged against the general cost of doing business and not against the "dub" trying to weld, where it should be charged. Employers know that they will need welders from time to time. There are many places where welders can learn the trade properly. It would seem good policy for the employers to encourage their men to take up trades of this nature when such excellent facilities are available as there are in a city like Detroit. Schools like the technical public schools, the Y. M. C. A. schools and the institution that I represent, the Michigan State Automobile School, offer thorough courses under expert instructors.

Next to burns come injuries to the eye. Most of them are absolutely preventable. Employers should compel their torch men and attendants to wear suitable goggles. It sounds easy and it is easy if the employer insists upon it. The torch flame looks harmless, but from it, as you know, constantly emanate rays which are destructive to the delicate mechanism of the human eye. A suitable goggle intercepts these rays. It also intercepts particles of rust and scale exploded from the surface of rapidly heated metal.

I remember asking a garage proprietor not long ago why he was willing to risk his eyesight by using a torch and not wearing goggles. He politely invited me to get the h——l out of there and mind my own business. Not many employers or boss welders are as bone-headed as he was and yet you will find plenty of welders at work this very day with absolutely no protection for their eyes.

All sorts of helmets, goggles, body protecting devices, asbestos shoes and so forth are today available to the welder. Make him use them. Make it easy for the welder to carry on his trade in comparative safety. When he gets hurt it costs you as an employer money. Maybe you pay it out of the pocket labeled "first aid" or "running expenses" or "overhead." But you pay it. It adds to your expense of doing bunsiness.

Insist on frequent and adequate inspection of all apparatus.

Insist that all hot articles be suitably marked.

Force the workmen to wear proper goggles and protecting devices.

Properly ventilate the welding shop to carry away any escaping gases, thus minimizing the danger of a "shop" explosion.

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*Papers presented at the Safety Conference of the National Safety Council, Engineering Section and the Detroit Safety Council, Detroit, June 13, 1923.

[2] Michigan State Auto Schools, Detroit, Mich.

If tanks are used keep them out of direct sunlight and in a cool place, away from high temperatures.

Insist that none of your money goes to pay wages to a welder unless he is properly trained. If you refuse to employ the untrained green man he will manage to get proper training to fit himself for the job.

Properly instruct every employe who in any way comes in contact with the welding shop, in regard to the hazards found in that shop. If he fails to observe reasonable precaution after such instruction, get him off the pay roll until such time as he has gained suitable training. It will save the employer money and make welding shops safe for those who work in them.

SAFETY OF ELECTRIC WELDING AND CUTTING

By D. H. DeYoe[1]

THE art of welding and cutting by means of the electric arc is subject to certain safeguards recommended by fire insurance and safety organizations for the preservation of property in which they are used and for protecting the health, eyes, and bodies of the operators. Experience has shown that the fire hazard is not serious due to the fact that the immediate presence of the operator and the concentrated attention which his work requires help to prevent the start or spread of any fire originating from flying sparks or molten particles of metal.

For protection of the operator and of men working in the near vicinity it is necessary to take certain precautions. If these precautions are taken arc welding becomes a perfectly safe occupation. There are at present some sixty thousand welders using the arc. We have several welders at our plant who have worked steadily with the arc for six or seven years without any apparent bad effect. In ordinary arc welding, where currents ranging from 50 to 200 amperes only are used, simple precautions are necessary for the protection of the operator's eyes and the exposed portions of his body. The usual method of protecting eyes is the use of a face shield or head mask with glass window inserts, the glass of which is of such a composition as to absorb the injurious ultra-violet and infra red rays. When several welders are working in the same room, in addition to the use of face shields or head masks, colored glasses with side protection are worn to protect the eyes of each operator from the arcs of the others. All exposed parts of the body are subject to a burning effect from the rays of the arc. This burning is similar to a sunburn and if the body is not protected by a covering of some kind it will cause the operator more or less discomfort or pain. The body is usually covered by ordinary close woven clothing and the hands by leather gloves not only to protect against the rays of the arc but against flying particles of hot metal. The gloves further protect him in handling hot parts. In heavy carbon arc welding and cutting where currents from 200 to 1,000 amperes are used it is necessary to protect the operator still further, as with these heavy currents the arc rays will penertate the ordinary clothing and the flying particles of molten metal will burn through them. Usually a large well fitting leather or asbestos apron is used protecting as much of the body of the operator as is possible.

For the protection of men working in the near vicinity of an arc welder opaque screens should be placed between the arc and the workers, or better still a booth should be built around the operator thereby shutting off all the arc rays from the surrounding part of the factory.

Care has to be taken regarding the painting of the interior of an arc welding booth. If a paint that reflects the rays of an arc is used the operator may be subjected to eye flashes from the side, and back of his face shield, or to the burning of the back of his neck or ears. A paint should be used on the interior of a booth and on all machinery located within same that will absorb the dangerous rays. A simple satisfactory paint for this use is composed of zinc oxide and oil which may be given any desired tint with lamp black.

Where heavy welding or cutting is being done and where galvanized iron or steel or materials that are oily is being welded it is very desirable in safeguarding the health of the operator to provide ventilation ducts or fans to carry away the smoke and fumes.

In metallic arc welding where direct current is used with an open circuit voltage of from 40 to 60 volts and a welding voltage of 20 it is not necessary to pay much attention to the protection of the operator from an electric shock. With alternating current welding this is a little more serious as the operating voltage ranges from 100 volts up to as high as 175. If the operator is not careful while changing electrodes this is liable to give him quite a shock. There is really, however, no way to protect the operator against this voltage as he is in direct contact with one side of the circuit in handling his work and with the other side of the circuit in inserting his electrode material. He must in turn be careful not to get in contact with both at the same time. This same condition applies to resistance welders used for railway work where the trolley voltage is from 450 to 650 direct current. In this case it is necessary for the operator to be very careful to keep free from grounds while changing electrodes. Welding resistors for use in railway welding are sometimes provided with a push button station under the control of the welder for opening a contactor in the welding circuit while changing electrodes. However, many welders object to carrying around this push button station and would rather take the extra precaution when changing electrodes.

In many installations where a large number of small articles are welded, particularly with the automatic welder, instead of building a booth around the operator to protect outside workers and instead of providing the operator with a mask or face shield an enclosed cabinet is built around the operation itself, inserting in this cabinet a colored glass protective window through which the operator can watch the progress of the welding.

Where many welders are working on small work it is customary to build a series of small booths, the tops of which are open and extend above the operator's head, the front of the booths being supplied with the welding control apparatus and with a bench on which material to be welded is placed. The backs of the booths are protected with a series of curtains which are closed by the operators before starting to weld. This makes a very compact and satisfactory arrangement.

For the protection of welding apparatus, safeguards, as applied to apparatus of similar nature, are used such as circuit breakers, contactors, fuses, enclosed switches, enclosing boxes for control apparatus, insulated couplings, gear cases, insulated holders, etc.

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[1] *Power and Mining Engineering Department, General Electric Co., Schenectady, N. Y.*

A. S. M. E. HOLDS WELDING SESSION AT HARTFORD, CONN.

At a recent meeting of the Hartford, Connecticut, section of the American Society of Mechanical Engineers, the subject for discussion for the evening was welding. Mr. P. P. Pipes, of the Lincoln Electric Company, presented a comprehensive paper on the subject of electric welding. This paper included the history and description of electric resistance welding, electric arc welding and electro percussive welding. Special attention was given to the theory and application of the Metallic Arc process.

R. L. Brown, of the Metal & Thermit Corporation, New York, gave a talk on Thermit Welding. This talk described the history of Thermit Welding, the Thermit re-action, the various kinds of Thermit welds and the procedure followed in making them. Some of the more important fields of subjects were discussed to show how extensively the process of welding is being employed at the present time.

REPAIR OF DIES BY WELDING

Arc Process Used on Forging Dies and Plate Shear Blades—Substantial Economies Claimed

By A. M. Candy*

SUPERINTENDENTS and foremen of drop forging and similar shops making use of steel blanking dies have been in the need of a satisfactory "putting on" tool to take care of chipped and broken edges of dies which have a rapid rate of deterioration, especially in certain forging operations. The ability to withstand the stresses imposed upon this material had made us skeptical in the past about applying the metallic electrode arc welding process for reclaiming damaged dies. Recently, however, we have found that such dies when properly prepared and welded show a sufficient increase in length of life to more than pay for the cost of the welding operation.

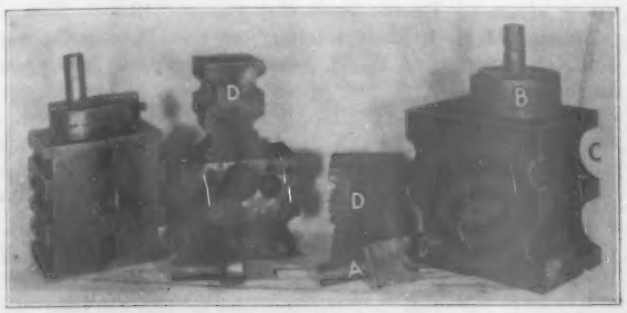

Fig. 1. Repairing These Dies by Welding Is the Work of a Few Moments.

A group of blanking dies used in forming eye rods and bolt heads, which were successfully repaired is shown in Fig. 1. At "A" is an eye forming plunger used in connection with a die for forming the blank ends for eye rods. This was broken diagonally across the center of the flat portion, commencing about at the middle of the circular groove at the end. The broken piece was welded to the main body and ground up, making the piece quite as good as new. The line of the weld can be discerned by the slightly darker area running diagonally across the front face of this plunger. The set of dies at "C" is used for forming the hexagonal heads for large bolts. These dies have a tendency to break off at the edge of the openings for forming the heads, which openings have been welded and ground and filed to the proper contour as indicated. A pair of dies of this type is worth from $35 to $50, and the cost of reclaiming is, as a rule, from $5 to $10, depending upon the extent of the damage to the die. The life of the welded die will be from 50 to 80 per cent of that of a new die.

The piece at "B" is the cup portion of a die used for forming the hexagonal head of a bolt and is also subject to chipping along the edge. It can be repaired in a few moments by the arc welding process. The pieces at "DD" are the two portions of a similar hexagonal-head bolt forming die which have been repaired, the illustrations showing the pieces before the arc deposited metal has been ground and filed to the proper contour. The other specimens shown in Fig. 1 are similar dies which have been salvaged for further service by the same operations.

All of this welding work is performed by the metallic electrode welding process, using a special high-carbon welding wire which will show an analysis of approximately 1 per cent carbon and about 0.6 per cent manganese. The metal deposited by the arc when using this wire will show an analysis of approximately ½ per cent carbon and approximately 0.30 to 0.35 per cent manganese. The deposited metal is not quite as hard as the original die material, but it is sufficiently hard to withstand the service and show a very satisfactory life. There is actually an advantage in not having the deposited metal quite so hard because it is much easier to dress up the welded portions to the proper dimensions and shape. This can be done conveniently by grinding as much of the metal as possible and then finishing up with a very fine file.

Plate Shear Blades Reclaimed

A similar application of the arc welding process is that of repairing a broken shear blade of a large plate shear. Fig. 2 shows a portion of such a shear blade the total length of which is 120 inches, the width approximately 8 inches, and the thickness 1½ inches. The breaking of this blade was caused by the breaking of the liner which is placed back of the upper edge of the blade, and a piece of the liner becoming separated. This concentrated the loading on the shear blade at a single point approximately 2 feet from the end of the blade. To prepare the blade for welding the two pieces were beveled off at an angle of approximately 45 degrees along the line of the break. The two pieces were then clamped together by means of strips bolted through the holes in the shank of the blade. The welding work

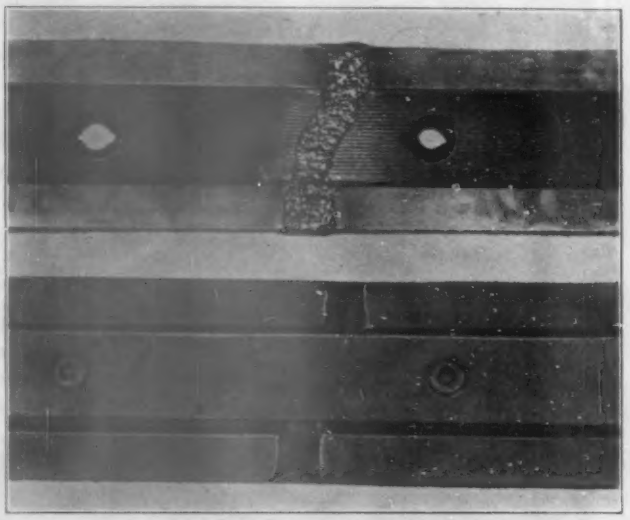

Fig. 2. Welding Repair on Shear Blade.

at the exposed portion of the break was then carried on until both edges of the blade were filled up. After this the clamping strips were removed and the welding at the web of the blade was completed. Very careful operation was required in doing this welding work, it being necessary to turn the blade from side to side so as not to concentrate the welding work on any one side for too great a length of time. In this manner, the alinement of the blade was held so close that it was impossible to see any misalinement by sighting along the edge of the shear blade.

This blade has been in continuous service, cutting ¼, ⅜ and ½-inch plate material, operating day and night for 60 days, and the first cutting edge is yet in very satisfactory shape. The blade, of course, has four cutting edges and therefore the total life of the welded blade will undoubtedly run into several months' time.

A shear blade of this type costs approximately $150. The time required to repair the blade for the welding work was approximately six hours and the welding time for the operation was approximately three hours. The total cost, therefore, for

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General Engineering Department, Westinghouse Electric & Mfg. Co.

completing the job, including overhead and all details, was well under $20. The finished weld in the shear blade is shown in Fig. 2. Before putting into service the cutting faces and edges were ground to a true surface to conform to the remainder of the blade.

The success of the welding operations on these dies and the shear blade opens up a new and profitable field for the application of the electric arc welding process.—*Iron Age.*

OVALS MAKE PIPE CUTTING SIMPLE

By Grady Triplett

Cutting pipe for a right-angle welded jont is a simple process by use of a wire oval, the invention of Henry Miller of the Skelly Oil Company of Tulsa, Oklahoma. His device, which is distributed by the Tulsa Oxy-Hydro Company of Tulsa, is being adopted throughout the oil industry, where pipe welding is in use.

Oval for Marking Pipe.

The ovals are manufactured in a series, one for each size of pipe. With them, proper cutting for the right angle joint is only a matter of making four chalk marks and then following them with the cutting torch.

The ovals are especially popular with welding crews around refineries, natural gasoline plants and pipe line pumping stations, where hundreds of welded joints are specified, many of them right angle joints.

Comparatively few welders in this type of construction have given any thought to calculations for pipe cutting on joints of various angles. Even the right angle joints have for the most part been marked by superintendents and foremen, before torches were applied to cutting. This caused much lost time on the part of welders, who were compelled to wait until pipe had been marked.

With a set of the oval measuring devices as part of his equipment, no welder need wait for supervision, with only a right angle joint to be cut and welded.

When the welder knows where the joint is to be welded, he is ready for work. The oval for the size of pipe being welded is put in place as illustrated, the two notches at each side of the oval, being at the center of the joint. In this position a line is drawn with chalk, either half way or completely around the pipe.

Then the oval is swung over, the notches serving as pivots. The oval is again drawn until it fits snugly, the notches at either side falling upon the line previously drawn. Another line is drawn and the surface within the lines is ready to be removed with the cutting torch.

This process is repeated on the joint of pipe to be welded at right angles, except that the marking and cutting are done at the end of the pipe.

ELECTRIC STEEL FOUNDERS' RESEARCH GROUP HOLD MEETING

The Electric Steel Founders' Research Group held a regular meeting of executives of the five electric steel foundries conducting co-operative research work, at Wernersville, Pa., on May 14 to May 17. Those in attendance were: W. J. Nugent, vice-president of Electric Steel Co., Chicago, Ill.; C. S. Koch, president, and H. J. Koch, secretary, of Fort Pitt Steel Casting Co., McKeesport, Pa.; W. H. Worrilow, president, T. S. Quinn, treasurer, and K. V. Wheeler, general manager, of Lebanon Steel Foundry, Lebanon, Pa.; R. F. Flinterman, president, and H. A. Neal, manager, of Michigan Steel Casting Co., Detroit, Mich.; C. R. Messinger, vice-president, R. J. Doty, vice-president, and B. Fleeger, treasurer, of Sivyer Steel Casting Co., Milwaukee, Wis.; and R. A. Bull, Research Director of the Group.

The various phases of the research work being done by the members of the Group, to improve the quality of steel castings and increase efficiency in methods, were discussed in detail. Formal reports giving the status of the present research investigations were read on such subjects as facing sand mixtures, core sand mixtures, electric furnace practice, heat treatment of steel castings, production control, porosity in castings, etc.

At this meeting plans were made for conducting research investigations on additional steel foundry problems. The results obtained from the work done so far have been so beneficial as to make it highly desirable to intensively study some of the additional complex problems involved in making thin section electric steel castings of intricate design.

The Siemund Wenzel, formerly located at 50 Church St., New York City, New York, has moved to 81 Hancock St., Long Island City, New York.

Marking for Tee Weld. **Preparing an Elbow.** **Tee Ready for Welding.**

The Detroit office of the Purox has moved to a new location at 620 East Hancock Ave., where they have more space and facilities for handling business.

The Gibb Instrument Co. of Bay City, Mich., manufacturers of electric welding equipment, have opened a sales office in Cleveland, Ohio, at 2104 E. Superior Avenue, in charge of Mr. W. O. Little.

TRACTOR WHEEL PROBLEMS

Providing for Contraction When Welding Spokes—Making Use of Carbon Paste in a Difficult Piece of Shape Welding

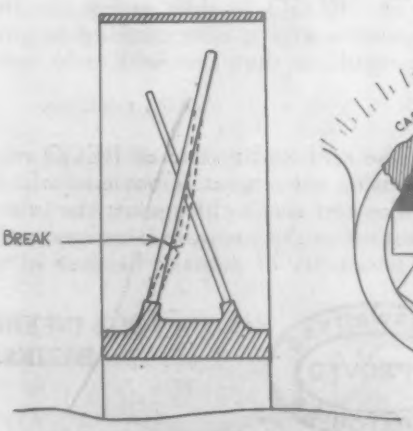
My dear Ed:

Talk about your hot weather; today certainly was the limit. It was so warm Ed. that the boys were actually frying eggs on the sidewalks. The sweat was rolling off "yours truly" in such streams that if I felt half inclined I could just remove my clothes and start swimming. You'll grant that it was some warm. When a fellow thought of a welding flame it was with a feeling that after all it wasn't so awfully hot.

I didn't try to do any work today on that account and I'm sure the boss wouldn't blame me a bit if he knew the circumsances. However, I did run across a mighty clever stunt or two yesterday that I want to impart to you. I would have written you yesterday about them only I got tied up in one of those all night sessions, so had to let it go. It has to do with a tractor wheel and I think you'll agree with me, that it's one of the best problems I've stumbled on yet.

Having occasion to go up to a contractor's camp I figured the day would be a blank. My report indicated that there was no welding equipment there. Imagine my surprise when the "Super" told me that they had been doing their own welding for the past six years. He was a fine old fellow and took considerable pride in what his welder undertook. When he learned who I was he took it upon himself to escort me to the place they did their welding. Well sir! The welder was the most reserved and conservative lad I've ever met in this game. No boasting whatsoever. Sounds rather strange, doesn't it, but nevertheless I'm telling you the truth. You couldn't help but like him. Very slow in his actions and when tackling a job, as he did several while I was there, he seemed to do all his thinking beforehand and then go about it with nary a hitch.

Well, the wheel I mentioned was standing alongside the shop. The "Super" pointed it out to me with so much warmth that I decided I'd have to get all the dope. It was easy to see that it was a first class job so at the first opportunity I asked the welder about it.



Bending the Spoke Before Welding.

Preparing the Carbon Mold.

"Oh yes!" he said, "We get quite a few of those to fix up. At times the work on the grade is pretty rough and that's when they start breaking."

"Evidently this one was broken through the hub." I ventured. "The metal doesn't look like cast iron but I see that it's a cast iron weld though."

"Yes, it's cast iron alright," he replied, "but on that wheel the hub wasn't broken all the way through. There was only a small piece knocked off the outside. One of the boys took a picture of it before I welded it. If you'd like to see it I'll get it for you."

Naturally I wanted to have a look at it, so he went back in the shop and returned in a couple of minutes with two different views. You'll find one enclosed for I proceeded to beg it off him.

"It's plain to see the nature of the break in the picture," I commented. "How did you go about the job? I suppose you

Many of These Tractor Wheels Are in Service in Farming Districts.

ground off the small part that broke off and then preheated the hub a bit?"

"No, it couldn't be done that way simply because the small part was lost and couldn't be found," he answered. "You see in this case a mold had to be made and a new piece formed. This ordinarily would not be very difficult but on account of the curved surface and accuracy required it became more complicated."

"I wish you'd explain just how you went about the preparation." I said; "Did you use carbon blocks?"

"The preparation wasn't very difficult," he replied. "First the wheel was rolled around until the broken part of the hub was on top, in order to let the weld be made in a horizontal position. I didn't have any carbon blocks large enough so I had to use a fireproof compound which I molded to shape on top of a fire brick. After scraping all the surplus compound off the edge of the break, the welding torch was played lightly over the mold to help it "Set." The rest was easy. A good sized welding flame applied to the metal back of the break, soon got it red hot and then the flame was concentrated on the broken edge and the weld begun. It was simply a case of melting the filler and rod and fusing it to the edge. Of course a good bit of care had to be used in playing the flame so it struck only the metal and not the mold; outside of that, it was just an ordinary cast iron weld."

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THE NEW REGO NOZZLE and seat constructio and compression of the gas of the regulator a turn the full tank pressure of about 2,000 pounds per causes lightning-like movement of the regulator part invariably in spontaneous combustion of the regulat of the best engineers in the industry for years. I is embodied in REGO trade-marked regulators.

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Gases for welding and cutting are usually s pressure in the tank naturally falls. Good welds a at absolutely uniform and constant pressure and v pressure but volume has been sacrificed and vice ver actual use to be so constructed as to maintain absol an ample and constant volume.

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...tents applied for) prevents the ignition, from friction ...perators, despite all cautions, will occasionally suddenly ...e inch, into the regulator with the valve open. This ... terrific compression of the gas at the nozzle, resulting ... The prevention of this difficulty has been the problem ...tion has finally been reached by REGO engineers and it

...FEATURES

... pressure regulators. They embody other exclusive ...ice (patented) absolutely prevents the disastrous burst... excess pressure in the body. This condition of excess ... falls over or the torch back fires. A bonnet with vent ...iaphragm must also be relieved of the sudden tremen...ically and safely.

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... under considerable pressure. As the gas is used the ...omical cuts can only be obtained with a supply of gas ...t the torch. Some regulators are fairly accurate as to ...EGO regulators have been proven in **laboratory** and ...niform high or low **pressure** at the outlet and to deliver

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...t together by the positive action of the gas pressure. ...ure of gas against the interior of the diaphragm pulls ...ure of the nozzle against the seat increases in the same ...lator—the more pressure—the tighter the seat. There ... springs.

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"But why the extra precautions about handling the flame? Wasn't the mold fireproof?" I questioned.

"Yes, to a certain extent, but you might say that cast iron was also fireproof," he said. "You see, the oxy-acetylene flame is mighty powerful and it is far better not to take any chances. Personally I have always found it to be desirable, instead of allowing the flame itself to come in contact with the mold, to melt the metal on the edge and let it run down and cover the mold. After that covering is made, as much more metal can be built up as desired."

I took another look at the weld Ed. and examined it more closely. "Do you mean to tell me that there has been no machine work on this weld?" I exclaimed.

"Not a particle," he answered.

"My hat's off to you, Sir!" I replied, "That sure is a pretty piece of work. I was under the impression that it had been ground out, from the looks."

"I've had many welders think the same as you did, but really it's all in the manner in which the mold is prepared. If the proper care and pains are given it and the metal allowed to cover it in the manner I've just outlined, good results are bound to follow."

At this point there was a rush job came up for him to do so he went in the shop. I followed him just to get a glimpse of how he handled his torch. As I told you before Ed, he seemed to size up his job and take plenty of time in so doing, but after he got under way, he sailed right along.

I saw that the job he was working on would take him a little while so I went back to have another look at that wheel. It was then I happened to notice in the picture that many of the spokes were broken. They had all been welded so cleverly that I hadn't noticed the welds when looking over the wheel itself.

After finishing his job I called him out and asked him about the spokes. Evidently that's just what he was expecting for when he heard me mention spokes, he smiled and said, "I was wondering whether you would notice them. They presented a much more difficult job than the hub. You see they are made of steel and if welded without provision for contraction they either tend to pull the rim out, or else they break in the weld. We had to weld a great many of these wheels before we hit upon a method that would bat one hundred percent. In a measure, the 'old man' who brought you down here was responsible for the answer and that's why he takes more than a passing interest in my shop. He comes down here quite often for a little chat with me."

"Now, when we had tried to weld several of these wheels with busted spokes," he continued, "and weren't getting anyplace, the 'old boy' came down one day and said, 'Joe! I'm going to tell you how to weld those tractor wheel spokes.' 'That's Jake with me, Judge,' I answered, 'I sure do wish that the answer would come quick for they are causing me a whole lot of worry.' Well, do you know his suggestion was a darn good one and it turned the trick. Simple too."

"Sometimes it's those simple things that a fellow overlooks," I remarked.

"That was the case here all right. I've often kicked myself all over the lot for not having figured it out for myself," he mused.

"But come! Aren't you going to tell me the answer?" I interrupted.

"Surest thing, you know," he replied. "The 'Old man' put it this way:—'Joe, you are trying to do the impossible. The shortest distance between two points is a straight line and you can't make it any shorter. It appears to me that that is exactly what you are trying to do with those spokes. You tell me that you aren't getting contraction allowance. You never will as long as you stick to the straight line. Do you get what I mean? Now why don't you bend one of those spokes a little before you start your weld and see if she doesn't straighten herself up and take care of the contraction as it cools?' Now that's just the way he put it up to me and I could see right away that he was on the right track so I said, 'Well, here she goes,' and I grabbed a heavy hammer and bent one of the spokes just as he advised. Then I made my weld and let it cool. Now the first weld didn't prove out extra good for I did too much bending before I made my weld and there was too much slack left in the spoke when it cooled down. I tried another and used just about half as much bend. That one came out fine and I have never had a single bit of trouble from that day 'til this."

"It's all in lining the work up the right way it would appear," I replied.

"You said it that time and believe me, that little incident did more for me than any other single thing in this welding business. It brought home to me the fact that the details are what counts in this game as well as in every other and having had my lesson I've never been stumped since. I honestly believe that it's just because I figure each job out beforehand and see what has to be overcome."

That, friend Ed., is the story of the tractor wheel. As matters stand at the present writing, my tongue is hanging out one side of my mouth and my throat is parched. All I have to do is close my eyes and I'd think I was in the Sahara Desert. Hot, I'll say she be. Under the circumstances I'll cease my ravings; enclose the picture and sign off with as much of a bang as a melted man can.

As ever, yours,

Shep.

A SYMBOL OF SAFETY

A SYMBOL OF SAFETY, is the title of a new book written by A. C. Brearley, and published by Doubleday-Page & Company, New York City.

The volume treats briefly of the history, and in detail, of the equipment and activities of the Underwriters Laboratories, Inc. The label of this organization is so well known, and so highly respected, and at the same time the real purpose of activities of the organization so frequently misunderstood that it required a book to make their work clear. The author of this volume has been given every opportunity to make a study of the work of Underwriters Laboratories, and in his treatment he gives a clear and complete idea of its extent, diversity, and significance.

The first part of the book tells the story of the growth of the laboratories and illustrates a number of the more important experiments carried out in laboratories. Then follows a series of appendices, discussing the label service, instruction service, specifications, special forms of service, standards and procedure.

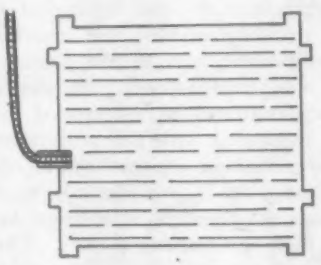
THERMIT RAIL PREHEATER BURNER ATTACHMENT USEFUL FOR MANY PURPOSES

The light weight thermit rail welding preheater, when used with the flaming burner attachment, has been found useful for many other valuable purposes, such as thawing out brake switches or car air brake pipes, melting spelter for setting hardened centers in special work, expanding for shrink fits, etc. It has been found especially useful, in fact, for work for which a large flaming burner is required.

In a recent case, one user reported that his preheater paid for itself several times over last winter, simply using the flaming burner which they put on for the above mentioned class of work. It seems they had considerable trouble with frozen air valves on their trolley cars and when a motorman called up reporting such trouble, they would simply send the preheater on a Ford truck and thaw the valves out.

SAFETY PRECAUTION AGAINST EXPLOSIONS OF VESSELS TO BE WELDED

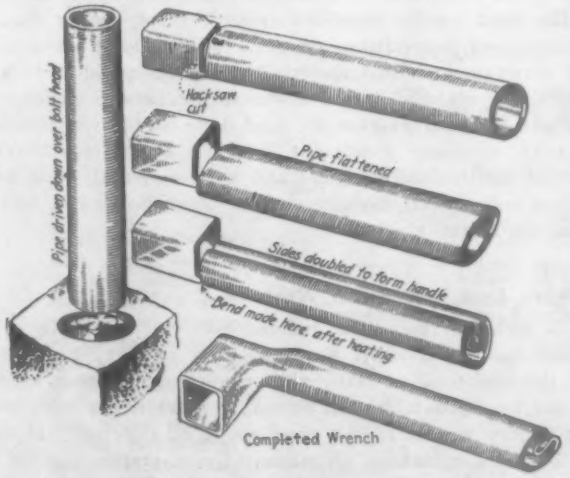
The constantly occurring accidents in the welding of leaky benzine, petroleum and oil tanks, resulting from the explosion of such containers leading not only to severe injuries but also to fatalities, have led to the following procedure in the case of repair work:



The vessel must be completely filled with water at the beginning of the work. The plug which must be screwed into the bung-hole is fitted with a vertical tube which is bent so as to communicate with the interior of the tank and is long enough so that the water-level will show when the tank is filled. The tube is held by a union so that it can be turned in all directions so that the vessel can be welded in any position. If pressure tends to result from the heating of the tank in the course of the work, water is forced from the tube, and all pressure in the tank itself is avoided. By filling the vessel with water the formation of explosive gas mixtures from the air and benzine or oil residues is prevented. Since the height of a vertical drum is only about 1 meter, the height of the water column (from the bung-hole at the middle) is at most 500 mm., a pressure easily exceeded by the gas pressures in the tank. Explosions are completely avoided in this manner.—*Die Warme.*

AN EASY JOB FOR A WELDER

An interesting example of emergency work which can be handled in any welding shop is described in a recent issue of the American Machinist. It is pointed out that a small shop is frequently called upon to furnish a wrench for some special purpose in a hurry. One example is given of a repair shop which was called upon to produce a wrench to handle a square head bolt set down in the frame of a tractor.



An Improvised Socket Wrench Easily Made in a Welding Shop.

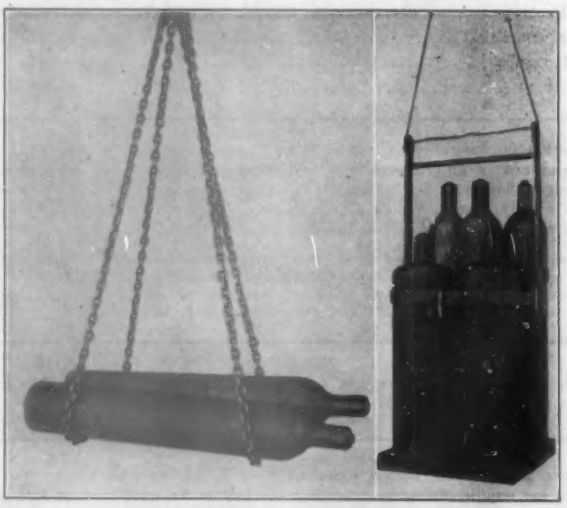
The sketch illustrates the method adopted to supply this tool with the least detail, and is worth noting because the wrench was made without forging or machinery, from a short length of seamless steel pipe, obtained from the scrap pile. To make this wrench, the end of the pipe was heated and drawn over the bolt head, next the pipe was sawed about three-quarters across with a hacksaw. The end was then flattened and bent double. It was heated before making the sharp bend at the junction of the handle and socket to avoid breaking.

While the wrench was hurriedly made, the result was a most satisfactory tool. This is a piece of work which could be handled with the greatest ease in a shop equipped with an oxy-acetylene torch. It is the work of only a few moments to produce the heat necessary for forming the scrap pipe into a serviceable wrench.

LESSENS THE DANGER BELOW

Safety devices form one of the important groups of topics for discussion in the Pullman News Monthly, house organ of the Pullman Company, of Chicago, Illinois.

A recent issue contains the safety suggestions illustrated in the Company's photographs. The old method of carrying acetylene



At the Left is Shown the Old, Dangerous Way of Carrying Cylinders, and at the Right the Safe Method Now in Use.

and oxygen gas tanks by travelling trains of the Pullman Car Works, is shown in the picture at the left. There was always the danger of the heavy tanks slipping from the chains from poor balancing or other possibilities, in which case it meant possibly death or injury to those below.

The picture at the right shows the method now used for carrying cylinders. This is a simple and inexpensive device, and practically eliminates the hazard instances to transporting cylinders from one part of the plant to another.

GAS PRODUCTS ASSOCIATION ANNOUNCES CONVENTION AT EXCELSIOR SPRINGS

The semi-annual convention of the Gas Products Association, will be held this year at the Elms Hotel, Excelsior Springs, Mo., June 26th, 27th, and 28th. This central location was selected, with the expectation that it would attract members from all parts of the country. Excelsior Springs is described as being a beautiful place, and is a very popular convention headquarters.

The golf course is described as an excellent one, and it is reported that several interesting matches have already been arranged by members who are not able to settle their arguments completely at last year's convention.

The Secretary of the Association has recently announced several important features of service which are available to members. The inauguration of an Employment Department is an especial interesting one, especially when the demand for Oxy-acetylene welders gets heavy. The proposal is that the Secretary shall keep on file the names and personal records of men who wish positions as welders or cutters, and when the customers of members desire such help, it will be possible to fill their requirements on short notice.

It is also proposed to trace a number of cylinders which have been lost in the past few years by offering a reward of $2.00 each for all cylinders which have been lost over a year.

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CONTENTS

Safety in Gas and Electric Welding and Cutting..... 21
Repair of Dies by Welding..... 23
Ovals Make Pipe Cutting Simple..... 24
Tractor Wheel Problems..... 25
Safety Precaution Against Explosions of Vessels to be Welded 29
An Easy Job for a Welder..... 29
Lessens the Danger Below..... 29
Editorial 30
Brazing a Gear Wheel..... 32
Hints for the Welder..... 33
Torch Cutting Steel Forgings..... 38
Small Shop Contract Work..... 46
Current Welding Literature..... 48

Science Organized for Service

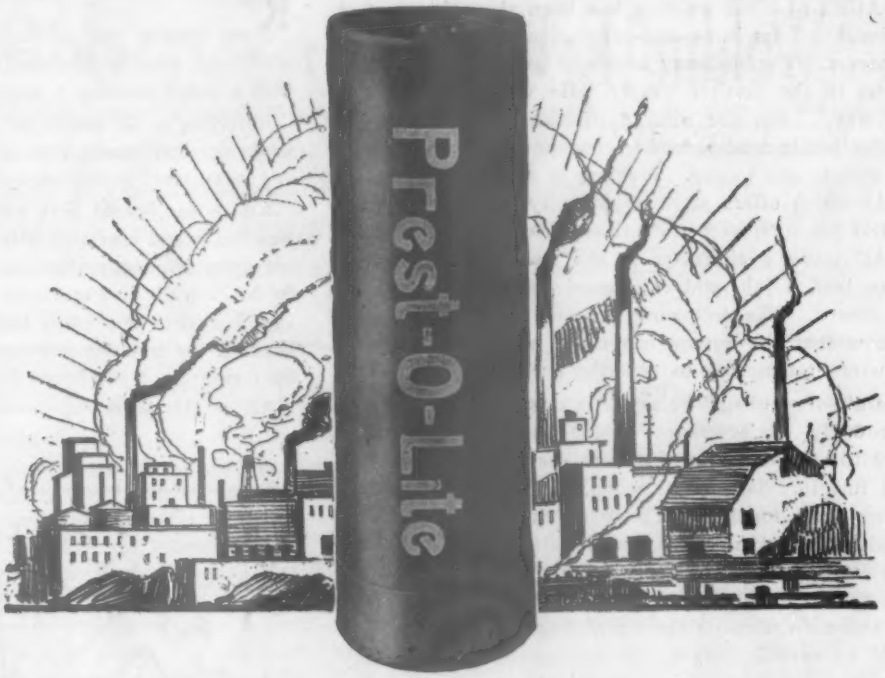
READING the recently published volume which describes the organization and activities of Underwriters' Laboratories, one is impressed by the unique spirit which is so evidently a vital part of the enterprise. In every department there is found the single purpose—to learn the truth. Reports on protective and preventive devices are not compiled to please the manufacturers of those devices, but to classify the products for the benefit of the public. It has taken some years to establish the soundness and integrity of their investigations, and in the meanwhile the institution has had a wonderful growth. It continues to grow. Originally the laboratories were intended for the investigation of problems connected with fire protection. The lack of similar facilities for making experiments in other directions has brought into the plant a considerable assortment of unrelated problems, such as testing thief-proof locks, automobile bumpers, mufflers and burglar alarms. The corporation itself is not operated for profit. It is the public which has profited, though it is impossible to estimate the extent. More institutions of this sort would be beneficial to American industries, by being the cause of setting up manufacturing standards. It is interesting to read that makers of wired glass windows scoffed at the idea of equipping for production of windows which could pass the tests of these laboratories, then turned about and did it. Science is rendering a real service when it points out the need for better products.

Welders for Welding Supervisors

GETTING results from a crew of welders is something not to be expected from the best of gang bosses, unless that particular boss happens to know the practical side of good welding, or is discreet enough to lean heavily on an experienced welder. The engineer in charge of construction work involving the use of welding has to find out for himself that a welder is not to be considered as a common laborer. If he doesn't find it out, it's just one more case where the welding process is underestimated and condemned. One of the most interesting jobs of the year was woefully mishandled because one man in authority chose to estimate the value of the weld by the depth of reinforcement, rather than by the depth of penetration. A good welder doesn't like to be told to waste time and materials piling up metal to look at. If he is the right kind of a workman, he likes to do his work well and get paid well for it. And there isn't any comparison, from an economy standpoint, between a poorly supervised crew of half-trained bunglers and a crew of real, good welders working under the direction of one who knows what is going on in the weld.

A Profit Leak in Contract Work

JOB welding shops are inclined to tread cautiously when approaching contract work, because so many have found that the sum total of many ventures into production welding has not been profitable. In numerous cases it has been found that failure to charge for time spent in experimental work "as a basis for making an estimate" was responsible for big leaks in profits. Contract work is unprofitable when these losses are allowed. It is safer to lose a few customers than to waste a lot of time, gas or current on experiments for which no charge is made. The welder is entitled to cost plus a profit for all the work done, and, to be perfectly safe, he is justified in withholding a piece-work bid until all jigs are paid for and the method of handling materials is well organized. It is very expensive to dicker with the prospective customer who wants a sample made up gratis, to test or to "see how it looks" on his expressed intention to order them by the hundreds, and the canny welder will immediately put a price on his services in making a sample.



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In the years since Acetylene first became a commercial product, users of the gas welding and cutting process have been offered many substitute fuel gases. Unwarranted claims for these substitutes have failed to stand the test of time and actual performance.

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DISSOLVED ACETYLENE

Welding Gets a Real Boost

OXY-ACETYLENE welding has been the subject of occasional articles in several semi-scientific magazines and in newspapers. The ordinary accounts given of the process are painful to the pratical welder. He wonders "how they get that way." But the most particular reader would find real satisfaction in reading what a contributor to our leading national weekly has to say. Welding is cited as an example of a trade which offers more opportunity than the ordinary white-collar job. "If you are not an absolute dumbbell, and will work," states a character in the story, "you can learn enough to land a job, and earn good wages while you are learning more." The following comment on welding as a trade shows that the author has made a real study of the subject before attempting to describe it:

"This craft of welding," he says, "is one of the new trades, and thoroughly characteristic of the shift in occupations. Yesterday the carpenter and cabinetmaker constructed buildings and furniture largely of wood, sawing out the pieces and nailing them together. Today metal is replacing wood in our buildings and furniture, and it is the welder with the oxy-acetylene torch or electric arc who cuts the pieces out and joins them together. The things he makes are not only fireproof and more durable but often cheaper than metal articles made by casting, forging or machining. In every sky-scraper that goes up there are thousands of metal window frames, sashes, door frames and doors with miles of metal trim. It all makes work for the welder. When the building is done and tenants move in, they bring metal furniture filing cabinets and other equipment—most of it welded instead of riveted, because welding makes better joints, more sightly designs and is cheaper. The rails in a trolley line are welded together or joined in an electric circuit by welded bonds, and so are railroad tracks with electric-signal systems. Every shipyard has hundreds of welding jobs, and parts for ships are cut out with the oxy-acetylene flame. Where the plumber once threaded pipe and screwed it together, now it is welded in a continuous line, often miles and miles of it. Welding has superseded riveting and soldering in the making of tanks. it is used to repair defective castings and broken parts, to cut metal parts on the pantograph principle."

This kind of publicity is good for the industry. It is refreshing to find in the course of the day's reading a common sense discussion like this, based on facts, for it indicates that welding is becoming better known.

More Welding in the Oil Fields

WHEN the welding process achieves a notable success in one application, there is often a similar job next door waiting to be tackled. At present the oil fields seem to be most active in finding new structures which can be welded. The all-welded mammoth storage tank is the next spectacular development to be expected, now that the practicability of welding bottoms and roofs has been demonstrated. But there will be an endless variety of less difficult jobs turning up where so much fabrication with plate and structural steel is necessary. For example, next door to the storage tank work recently described, an engineer has developed a floating roof for oil storage tanks. It is estimated that the use of this roof would mean the elimination of ninety-five per cent of evaporation losses. The specifications are said to call for five thousand feet of welding on each roof. Some of these construction men might well get together and establish a cooperative school of instruction in gas and electric welding as applied to the peculiar requirements of the oil fields. A "combination in restraint of poor welding" would be a good thing.

BRAZING A GEAR WHEEL

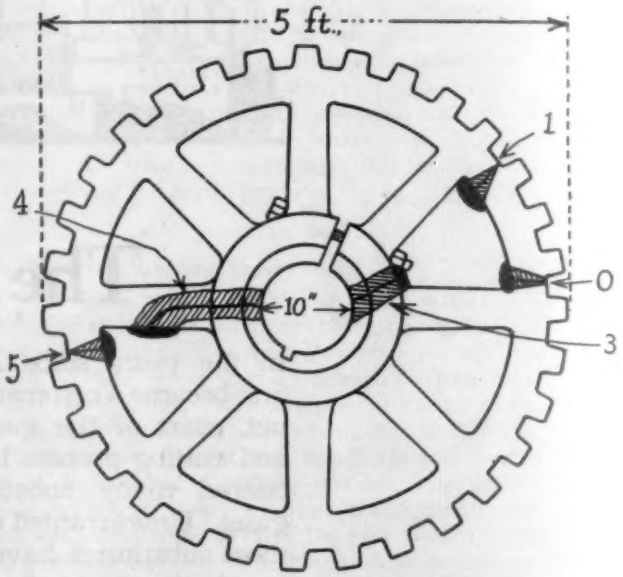
Editor:

I am sending you enclosed a sketch of a gear wheel. This wheel had been broken and welded. I have marked this wheel with a pencil showing it was broken and welded.

Referring to the sketch, all rim breaks were scarfed as marked, while the hub breaks were scarfed from the spokes to the bore and every scarf lacked one-quarter of an inch going through.

No. 0 was brazed first without preheating, then break No. 3 was the second operation without preheating, No. 4 was the third operation without preheating other than holding another torch on No. 3 while this operation was going on. While the hub was kept hot with one torch break No. 5 was brazed. Then still keeping the hub hot with one torch and occasionally heating operation No. 5 the break No. 1 was brazed.

All of this work was done with Tobin bronze, although the



Details of Brazing a Gear Wheel.

wheel was made of cast iron. All the rim breaks were scarfed about forty-five degrees, while the hub breaks were scarfed less than forty-five. In every operation the break was reinforced with the exception of on the face of the hub. This could not be reinforced because this wheel worked close to the shaft box on one side and another gear fit close to the hub on the other side. The operations were reinforced to make up for the strength account of not scarfing through. This wheel has a solid hub.

The size of this gear was five feet in diameter, eight inches across the face and eleven inches through the hub, with a ten-inch bore.

After this wheel got cold it was struck several times with a ten-pound hammer as a test. It has been back in service now five months on a bolt forging machine in the blacksmith shop. Every break came back exactly where it was before it broke and runs as true as if it had never been broken.

E. P. Duren.

Leo Kappertz, formerly proprietor of the Kappertz Auto Repair & Welding Works, Morristown, N. J., recently changed the name of his business to Kappertz Welding & Supply Co. The new concern will deal in welding apparatus, supplies and materials, and will furnish instruction in oxy-acetylene welding.

Hints for the Welder

When you finish an interesting piece of work, can you set down on paper the manner in which you went about the job. how you prepared the work and how the job was done? Have you learned some little stunt every welder ought to know? Contributions to this department are paid for. Write it down any old way – I'll polish it up. Make a rough pencil sketch and our draughtsman will fix it up fine. Line-drawings are more practical than photographs. Do it today – the men on the firing line are waiting. L. B. Mackenzie, Editor.

STRAIGHTENING SHAFTS

By A. McDongan

A week or two ago I had two interesting shaft straightening jobs which proved successful. The shafts were from the grinders of a pulp and paper mill. The material was of mild steel, each measuring 7 inches in diameter and about 10 feet in length. The first we decided to try seemed to be bent about 24 inches long near the center of the shaft; we found it to be 5/8 of an inch out of true. After setting shaft in a lathe on centers we drew a line along the concave side of bend. We next got an oxy-acetylene welding outfit using a welding tip that consumed approximately 80 cubic feet of acetylene per hour. We heated along the above line about 4 inches wide by 24 inches long until we got a good red heat, also at the same time playing a stream of cold water on the other side of the shaft. I figured seeing nothing can stop expansion, the hot side expanding would bend the cold side and finally straighten the shaft. To help things along I hammered the hot side lightly with a small machinist's hammer. When cold we measured it and found we had only 3/16 of an inch to go. We gave it another heat, but this time only about 9 inches in length and another hammering. After cooling we found it to be perfectly straight.

The second shaft measured the same as above, but the bend in it was sharp. The first may have been straightened by peening cold, but it would have been a long and tedious job. The second had been discarded as scrap. We set it up in a lathe in the same manner as the first one and drew a line on concave side, but instead of heating 24 inches, we heated about 12 by 5 inches wide, letting the heat soak in fairly well, also cooling off other side with running water and hammering the hot side sharply with hammer. We had to heat this one three times before we had the desired result.

This may not be a welding proposition, but by the use of the oxy-acetylene flame, with its high temperature on a small area, you get a quick heat always under control. Expansion does the rest.

This process might be used on many other steel parts, such as locomotive frames, etc.

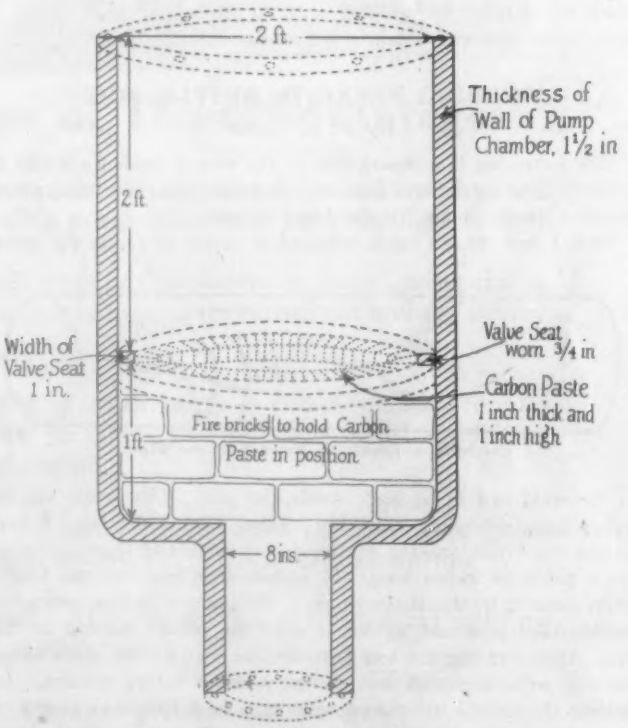
BUILDING UP VALVE SEATS

By J. W. Arnison

This story is about building up worn valve seats in pump chambers by metallic arc welding with a special cast iron electrode. This is an electrode composed of a mild steel core of special composition, coated with the necessary ingredients which amalgamating with the mild steel cause a deposit of grey cast iron in the weld. The flux is not fluid under the arc, but falls in the form of powder and the welder should aim at causing the fallen powder to amalgamate with the weld metal by playing the arc on it, that is, by manipulating the electrode in overlapping circles. The welding should proceed slowly and the metal of the work should be thoroughly amalgamated with the deposited weld metal. The longer the weld metal can be kept in a molten state, in view of the exigencies of the work, the better will be the resulting weld. All work must be preheated to make a successful weld with this electrode, also allowed to cool very slowly after the work is completed so as to produce an easily machined weld.

You will see by the rough sketch, more or less, what the pump chambers look like, and what had to be done to them.

First of all we thoroughly cleaned the valve seat which was worn 3/4 of an inch. Then we made a mould of carbon paste 1 in. thick and 1 in. high to fit inside the valve seat so as to


2 ft.
Thickness of Wall of Pump Chamber, 1½ in
2 ft
Width of Valve Seat 1 in.
Valve Seat worn ¾ in
Carbon Paste 1 inch thick and 1 inch high
Fire bricks to hold Carbon Paste in position.
1ft
8 ins

Building Up Valve Seats.

stop the molten metal from running away and hindering the progress of the work, also, it would be a waste of material, the 1 in. high being used so we would know when we had built the seat up sufficiently to allow for machining. We put the firebricks under the mould to keep it in position during the preheating and welding operation. Then we built a preheating oven of firebricks all around the pump chamber, leaving a few air spaces at the bottom and allowing enough room between the firebricks and the pump chamber so that we could put in our preheating fuel which was wood. The oven was 4 in. higher than the pump chamber. We filled up the space with the fuel, set it alight and

covered the top with sheet asbestos which had a hole in it to assist the preheating. When the pump chamber had reached a nice red heat, we put a couple of sheets of asbestos all around the chamber, but were careful not to put it nearer than 1¼ in. to the valve seat. Of course the asbestos was there to keep the heat from making it unpleasant for the operator. As another protection he wore woolen gloves, and every now and then he would dip same in a bucket of water, but was careful not to let any water drop on the pump chamber.

Then we started operations. First of all we set the machine to 200 amp. 70 volts, for we were going to work with ¼-in. electrodes, made the electrode positive, then bent the electrodes so that they were straight in line with the holder instead of the ordinary way, that is, at right angles, to make it easier to manipulate them, for if it was right angles you will see by the sketch that it would be very difficult to manipulate them. The electrodes were 18 in. long, but we only used 12 inches because the heat began to make it uncomfortable for the operator when 12 inches had been consumed.

We built up the seat to the height of the mould, then stopped as we knew we had built it up sufficiently. Then we covered it up with some more sheet asbestos so as to allow it to cool very slowly. When it was cold we put it in a lathe and machined it to size. There wasn't a single hard spot or blowhole in the whole seat. These are very troublesome in the majority of cast iron welds.

The engineer of the gold mine for which we did the job was so pleased that he sent us another dozen that had been thrown on the scrap heap. We now do practically all of our cast iron work by metallic arc welding and the special electrode which I have mentioned and obtain good results.

WELDING BREAK IN BUSTLE PIPE

By P. E. Boltz

The following is a description of the way I welded a break in a bustle pipe on a blast furnace. A bustle pipe is a pipe which supplies the hot blast for the blast furnace.

First I had enough brick removed in order to get at the break

Patching a Break in Blast Furnace Pipe.

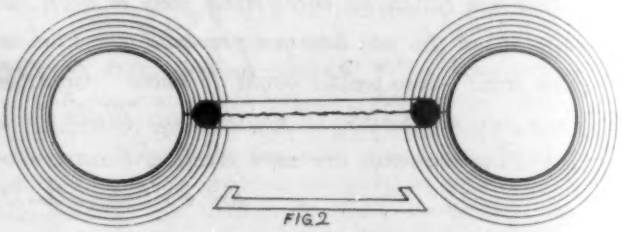
as the weld had to be made inside the pipe. The break was 32 inches long, extending from the bottom toward the top. I first welded the break, making the weld very wide and heavy. I next cut a patch 34 inches long, 5½ inches wide and had the blacksmith bend it to the shape of pipe, making the radius somewhat smaller than pipe and welded it over the break, starting at the end. After welding the end I heated the edge of the patch along the side with the torch and peened it down before welding. In welding the sides I alternated welding 4 or 5 inches so as not to warp the patch. By heating the edges and peening them down it left the patch high in the middle, thus allowing the patch to contract while cooling without breaking away from the pipe.

BRAZING CRACKS BETWEEN UNIT POSTS OF LOCOMOTIVE SUPERHEATER

A. W. Young, Kalamazoo, Mich.

In a job of this kind, if something can be added to the security of the brazing aside from the mere adhesion of the brass filler to cast iron, it is something gained. Cracks of this kind from one port hole to another break through the bevel concave seat of port holes and as the convex ends of unit pipes fit in these and are securely bolted up, the joint must be steam tight and the brazed crack must be strong enough to hold up under the full steam pressure of the locomotive.

In the sketch the series of circles represent the bevel seats of ports. In starting out first drill holes ½ inch deep with ¼-inch drill in bevel of ports at right angles to the bevel, as shown by



Crack Repaired So As To Hold Full Pressure.

black round spots on sketch. Cut a gutter ¼ inch deep from one drill hole to another, using narrow round-nose chisel, same width as drilled holes, as shown by parallel lines connecting circles with crack between. This gives a wide bottom for the brazing and adheres stronger than merely a sharp V edge at bottom of cut out.

In brazing use ⅛ bronze rod and a good-sized welding head. The object is to heat quickly the parts to be brazed. When sufficiently heated work filler in drilled hole allowing a little fullness beyond bevel of port. Continue across gutter to the other drill hole and fill. You have now formed a line of brazing with a hook on each end as shown in Fig. 2. The seats are now ground, the brass rapidly conforming to the bevel. When the units are bolted up, it is impossible for the brazing to get out.

WELDING TORCH USED TO SHRINK WHEELS

By J. L. Edwards

A short time ago we had some driving wheels come in for replacement of worn out ones on small interplant locomotive, these wheels being cast steel were ordered machined and finished, ready for service, but when they were being put on it was found that the holes in the center of the hub were .005 to .008 oversize. As these wheels had to have a driving fit on the axle they could not be used, and it was a case of either waiting for new ones or trying to fix the ones we had. We decided that the hole could be shrunk, but how to go about it and keep the wheel in alignment was a question.

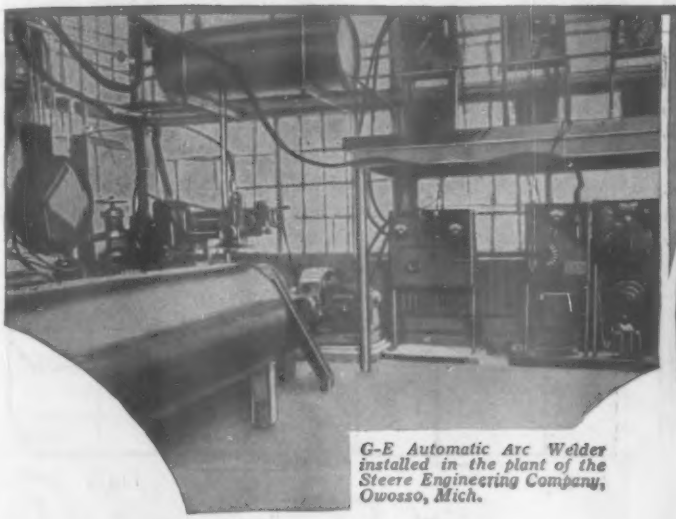
However, we got a steel barrel, welded a couple of lugs on the upper edge of it so as to allow a round bar of steel to rest on them across the barrel and put the wheel on the bar so that the wheel was hanging free in a vertical position. We then ran water into the barrel so as to just cover the rim, then we turned two preheating torches on the hub, one on each side, so that the flames played right where the hub and web join one another, rotating the wheel slowly so as to keep the rim cold. We heated the hub until a light cherry red, then started the water running again slowly until the water in the barrel reached up to within one inch of the hub, still keeping the wheel in motion until hub and all were cooled off.

After taking off the scale that had formed in heating, we checked the size of the hole and found that it shrunk .016, with all alignments perfect and the grain of the rim maintained its original shape. We proceeded with the rest of the wheels in the same manner, after which the holes were ground to size and the wheels put to service. They are giving satisfactory results today.

The wheels are about 20 in. in diameter, rim and hub cross section about 4 in. with a solid web about 2 in. thick.

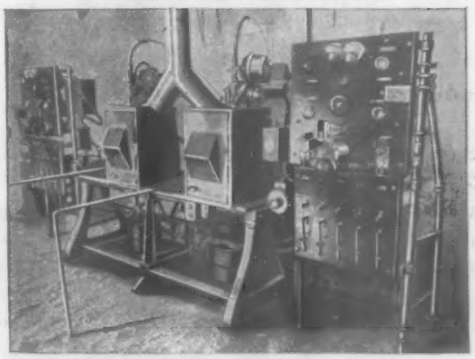
The Prest-O-Lite Co., Columbus, Ohio, and the Linde Air Products Co. recently purchased property on the south side of Marion Road, Columbus, and will erect a plant for the manufacture of acetylene and oxygen gas.

Why the Automatic Arc Welder?

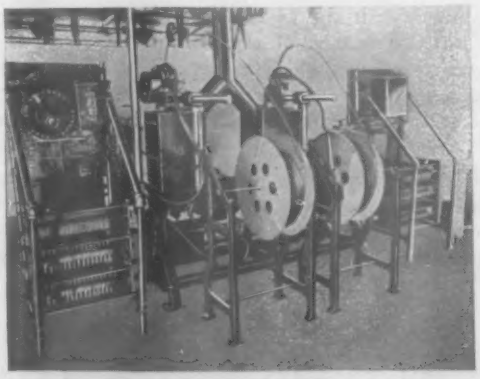


G-E Automatic Arc Welder installed in the plant of the Steere Engineering Company, Owosso, Mich.

At the plant of the Otto U. Hoffman Company, Philadelphia, Pa., a G-E Automatic Arc Welder is used for the welding of stocking forms.



G-E Automatic Arc Welders used in the Lowell plant of the Saco Lowell shops, largest manufacturers of textile machinery in the world.



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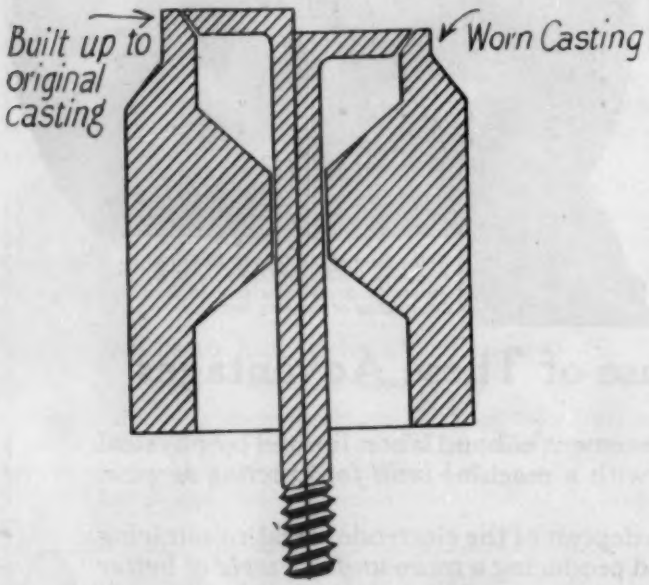
VALVE WELDS THAT GIVE SERVICE

By M. Twain

I wish to call your attention to a certain piece of work I recently completed that was looked upon by our mechanical department as practically impossible.

About eight months ago our superintendent came over with a sample of cage and valves from a Deisel Engine, a sketch of which I enclose. The trouble was that constant hammering had worn down the seats and face of the cage and valves, and further machine work was impossible unless the cage and the valves were built up by the welding process. The question came up in the mechanical department whether or not it was possible to build up the seats to be gas tight. The impression seemed to be that the elimination of porous imperfections was practically impossible in which event the job would be a complete failure. I felt convinced, however, that the job could be undertaken with success, and that the success or failure of the work lay entirely with the operator.



Both the Torch and the Arc Were Used on This Building Up Operation.

I have completed 25 sets and the job is a complete success. The valves were built up by the electric process and the cages with the oxy-acetylene, and there wasn't a hard spot or a blow-hole through all the machinery, and furthermore, the grain of the metal was better than the original casting. Eight months have passed and the chief engineer informs me they are giving perfect satisfaction. In event of failure they would have to wait four months to get them from Sweden.

AUTOMOBILE FRAME WELDING—WHY A PATCH?

By W. J. Field

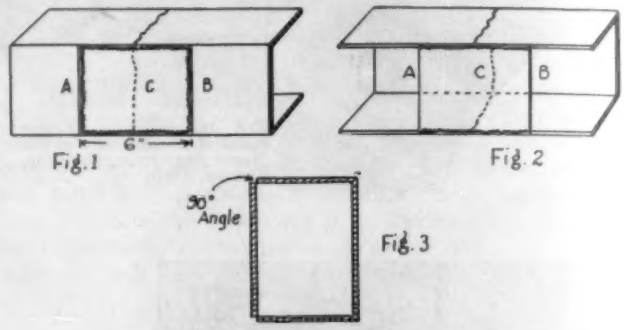
A weld is a casting and consequently cannot be equal to the original metal in a steel frame. If this is true in the case of a welded fracture it is equally true in the case of the patch, whose extremities A and B have been welded to the frame, because it must be remembered that the frame and the patch must be in a molten state before you can realize a weld.

The strength of a chain being a little *less* than that of its weakest link and assuming the fracture to have occurred in sound metal, then the point "C" represents the weakest part of the frame. In effecting the repair we have not removed the *cause* but simply attended to the complaint, so that after the patch is on, the load still falls on that section of the frame, and all we have really done is to transfer the weakest point 3 inches either side of the fracture.

Now let us consider the extent the patch has affected the resiliency of the frame and what will be the ultimate result of this stiffening of the frame by the patch. Let us illustrate.

A blacksmith places a steel rod on his anvil, takes a cold set and his mate strikes the set, driving it into the steel rod. Now suppose the smith and his mate performed the same operation on a wooden block instead of the anvil, would the result be as satisfactory? No—for the simple reason that the anvil lacked the resiliency that the wooden block possessed. This is exactly the case with the frame in its original sound condition, it yielded and then came back, the blow doing the minimum amount of damage; but when we put a patch on, the welded extremities of the patch being comparatively brittle offer but little *effective* resistance. The method which I have adopted and recommended (location of fracture permitting) is just to weld the fracture and then convert the frame from a channel to a box section as per sketches 2 and 3. The advantages, as I see them, are

1st—Less welding than on a patch of corresponding dimensions.



Dispensing With the Patch in Frame Welding.

2nd—A 90 degree groove is naturally formed by placing the plate as per Fig. 3.

3rd—Less total heat required in welding two edges than an edge to a surface, both edges being of equal section the possibility of getting a weld on one and an adhesion on the other is reduced to a minimum.

4th—The weld in the frame is supported by a double wall of *sound* metal, 3 inches either side.

5th—The box section is more flexible than a patch of corresponding dimensions.

6th—The additional vertical wall is stronger than a patch placed on the bottom, especially if the patch is welded on the ends as well as on the sides on account of crystalization of frame at a vital spot. The circumstance which makes it impossible to employ the method described is the intervention of cross members. In that case the patch welded on the *sides only* is the next best thing.

In conclusion, the indiscriminate use of the hammer by inexperienced welders in an endeavor to improve the quality of the metal in the weld is liable to bring about a condition where the cure is worse than the complaint. A careful re-heating of the welded area is, I think, much to be preferred.

William E. Brewster has resigned as advertising manager of the U. S. Light and Heat Corporation, Niagara Falls, N. Y., manufacturers of USL storage batteries, car lighting devices and electric arc welders, and has joined the Christian Science Monitor. His successor is E. D. Giauque.

The Gibb Instrument Co., of Bay City, Mich., manufacturers of electric welding equipment, have been appointed distributors of the General Electric Co.'s Arc Welding Electrodes in the Middle West.

Welded Pressure Vessels

For several years efforts have been made to draw up a Code for the Welding of Unfired Pressure Vessels. Opinions of the best welding experts were not in agreement on many essential points. Fundamental scientific knowledge based on test data was not available. The American Bureau of Welding has completed a series of tests on some 47 tanks. The program involved an expenditure of over $15,000. The test data, analysis of same, conclusions and recommendations to the Boiler Code Committee of the A. S. M. E. has been compiled in a report, copies of which are available for distribution at $1.50 to members and $5.00 to non-members.

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CUTTING STEEL FORGINGS*

How Heating Effects Are Removed by Normalizing—It Is Helpful to Have Forgings Preheated Before They Are Cut

By J. R. Dawson†

THE oxy-acetylene cutting torch is considered almost indispensable by many manufacturers of steel and steel products. Its use has increased with great rapidity and is retarded only by a lack of knowledge of the many advantages it offers. Of recent years the practice of torch cutting forgings to finished shape has become quite general, for by this means a great deal of time and expense are saved. Because of the large field for this work and the importance of the quality factor, a study has been made to ascertain the effects which result from use of process and how best to control them. Included is an explanation of correct procedure for carrying on this work and a discussion of the economies that are obtained by oxy-acetylene cutting.

Material Examined.

Two 4in.x6in. forged specimens, that had been cut on the 4in. side by a torch cutting apparatus, were selected for examination. The cut was regular and quite smooth. The chemical analysis of the steel was:

C.	Mn.	Si.	S.	P.
0.37	0.50	0.14	0.027	0.018%

The average Brinell hardness was as follows:

(a) Of steel not affected by cutting—143.

(b) Of torch-cut face, ground just enough to remove the oxide coating—207.

Examination for Cracks.

This investigation has consisted largely of macroscopic and microscopic examinations of the steel as affected by various conditions and treatments. The specimens were first examined by a hand magnifying glass on all faces and no cracks could be observed. Next the torch-cut face of one specimen was ground and polished just enough to remove the scale left by the operation. This surface was thoroughly examined in the same manner and no cracks were found. Throughout the investigation careful watch of both macroscopic and microscopic specimens has failed to reveal any cracking.

Depth of Heat Effect:

A second specimen was next ground and polished and etched on planes perpendicular to the cut as follows:

(a) At the top of specimen where the cutting flame entered the metal.

(b) Lengthwise of the cut.

(c) Bottom of cut where the flame emerged.

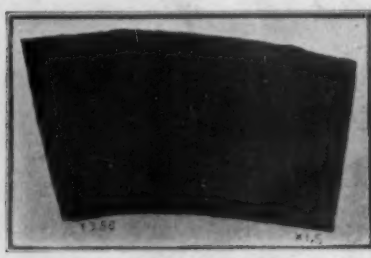

Fig. 1.

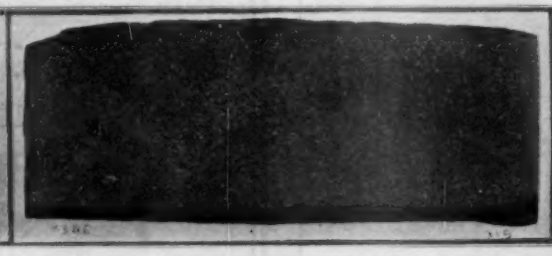

Fig. 2.

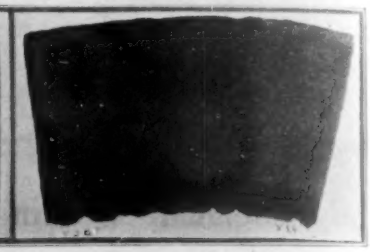

Fig. 3.

Fig. 1.

In Fig. 1 the darkened area shows the depth of metal that has been affected by the heating incident to the torch cut. The maximum depth of this area is ⅛".

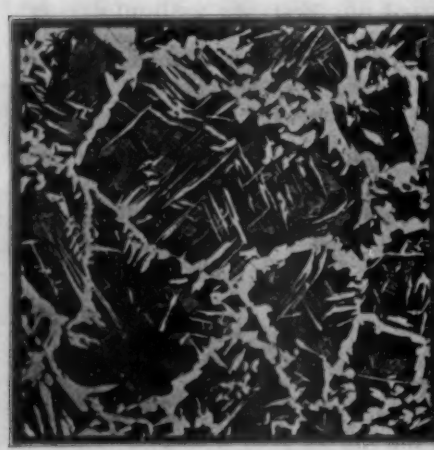

Fig. 4.

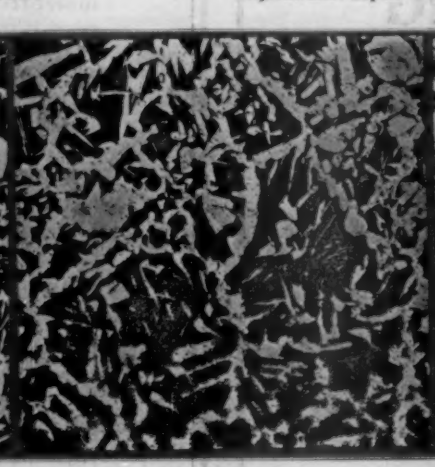

Fig. 5.

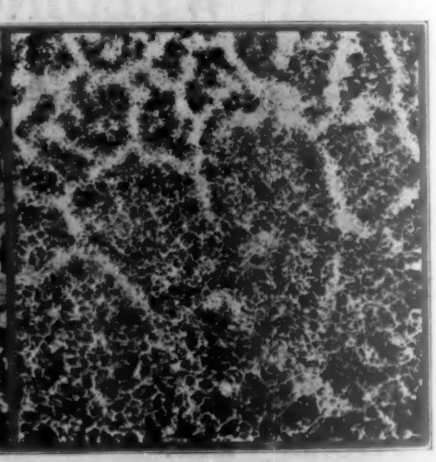

Fig. 6.

In Fig. 2 the top of the cut is at the left. It is shown that the depth of effect is quite uniform from the top to within ½" of the bottom, where it extends more deeply into the metal. The excellent character of the cut is shown by the smooth, straight line of the cut edge.

In Fig. 3 relatively light colored metal in irregular form is shown at the cut edge. The oxygen jet has melted and partially decarbonized some of the cut out steel which has run down to the bottom of the kerf and adhered to the forging. The heat contained in these melted drops has been sufficient to weld

---

Paper read before the International Acetylene Association, Chicago, Oct. 25, 1922.

†Union Carbide and Carbon Research Laboratories.

Note.—Macrographs are all magnified 1½ diameters. 10% solution of amonium persulphate used for etching.

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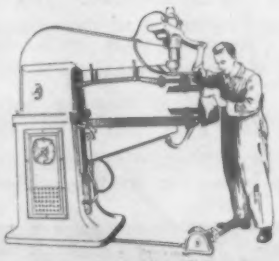

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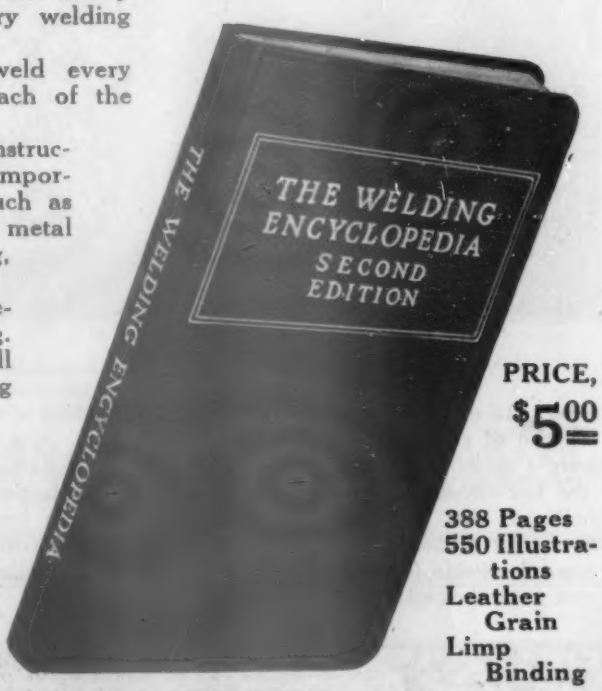

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them to the forging and by conduction to cause the heat penetration to be deeper at this point.

The maximum penetration as measured on the original photograph is slightly less than 3/8" and dividing by 1.5, the magnification used, gives less than 1/4" as the maximum actual depth of heat penetration.

Structural Changes Resulting from Cutting.

The following four micrographs are included to show the structures that are produced by torch cutting a steel of this character. All photomicrographs at 100 diameters. Etching with 5% solution of picric acid in alcohol.

Figure 4 shows the original structure of the forging. Except for the heat-affected area the structure of the entire forging is similar to that illustrated by this micrograph. The heat treatment that produces a structure of this type may be satisfactory and suitable for most forgings, yet there is no question but that more desirable structures should be obtained.

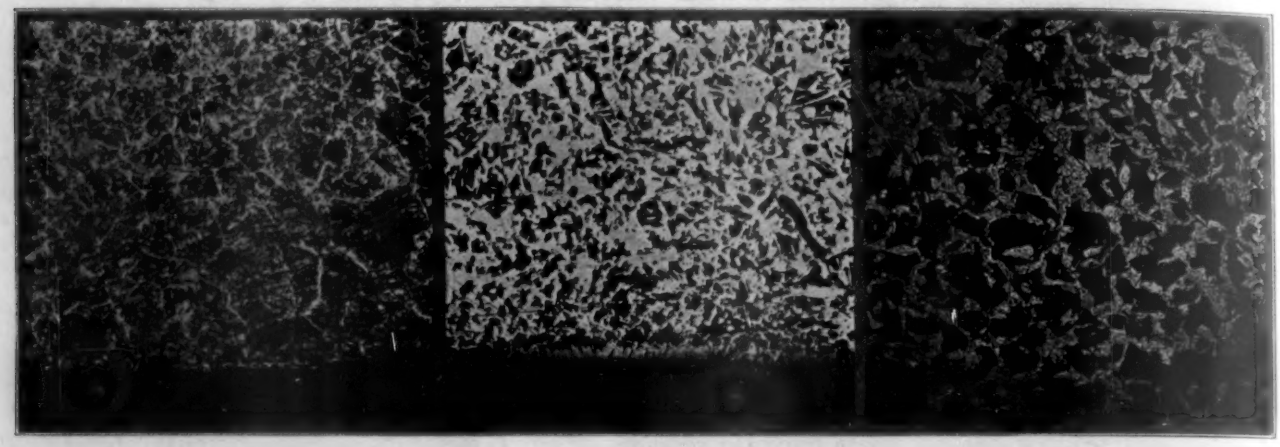

Fig. 7. Fig. 8. Fig. 9.

The micrograph, Fig. 5 shows the junction between the extreme point of heat effect and the unaffected original material. In the upper part of the micrograph is the original structure, which is characterized by large, irregular grains of pearlite surrounded by thick ferrite envelopes and containing needle-like areas of ferrite within and extending into these grains. In the lower part of the photograph the temperature of the metal has risen high enough to begin to break up the original structure by the absorption of the constituents, one into another. In this portion, the carbon containing constituent has been cooled more rapidly than was originally the case and is in a sorbitic rather than pearlitic condition.

Figure 6 was taken immediately adjacent to the previous micrograph. As the cut edge is approached the original grain structure is more and more nearly eliminated until finally at the bottom of the photograph it has entirely disappeared and in its place are small grains of sorbitic pearlite surrounded by ferrite envelopes.

Figure 7 was taken adjacent to Figure 6. As the cut edge which is shown here is approached, the heating has caused the grains to be somewhat larger than in the previous micrograph where the temperature was not quite so high. However, they are by no means so coarse as in the unaffected steel. The material shown in the preceding three micrographs is somewhat harder than when in its original condition. This hardening is brought about by the chilling action of the adjacent cold metal.

Normalizing of Torch Cut Forging

In this paper normalizing is used as meaning heating to sufficiently high temperatures 1400°F to 1650°F for example, to produce a refinement of the grain structure.

Low temperature annealing is heating to the neighborhood of 1250°F to relieve strains but not high enough to break up and refine the grain structure.

Fig. 10. Fig. 11. Fig. 12.

Sections that included both the areas affected by the heat of cutting and the unaffected areas were normalized and examined.

Figure 8 is of the same location as was shown in Fig. 7, which was of the torch cut edge. The piece has been normalized by heating to 1450°F, holding at that temperature ½ hour and cooling in the furnace. The same effect would be obtained by cooling a heavy section in the air. The structure of the edge and the interior of the specimen were practically the

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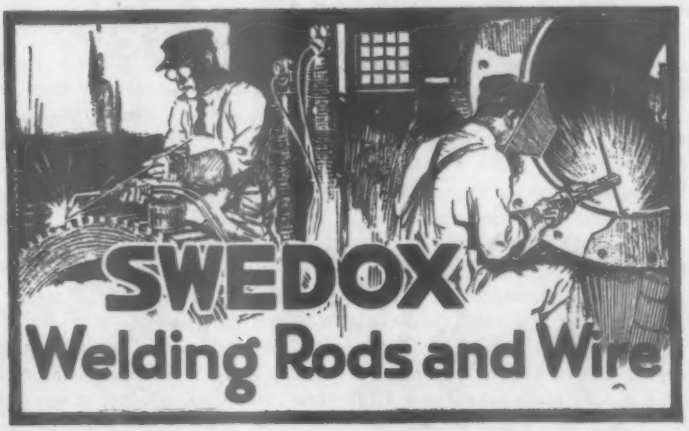

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same. All traces of the torch effect have been removed and the coarse structure of the forging has at the same time been much improved.

Figure 9 shows the structure of torch cut edge after normalizing at 1600°F for one hour and followed by slow cooling. The grains are larger than were obtained with the 1450°F for ½-hour treatment, which indicates that the shorter time, lower temperature normalizing is to be preferred.

Figure 10 is of the interior of same specimen as was shown in Fig. 9. The appearance of the two is practically the same, showing that the structure is refined throughout the material.

Torch Cutting Red Hot Steel

Specimen of this steel was placed in a furnace and heated to about 1450°F, then removed and cut by the torch while at this temperature, and then cooled in the air.

In the macrograph (Figure 11) is shown the etched section of the steel cut while hot. The cut was made along the left hand edge where it can be observed that the grains are coarser than in the remainder of the specimen. It should also be observed that no line of heat effect is evident, as was the case in the specimen as cut cold that was first examined.

The structure shown in Figure 12, of the edge cut red hot, is similar to that of the original untreated steel, but is more desirable because it is less coarse.

Figure 13 is of the interior of the same specimen as was shown in Fig. 12, which is of steel cut while red hot and cooled in the air. The heating previous to cutting has refined the structure nicely.

Returning Piece to Furnace After Torch Cutting While Red Hot

A specimen of the same steel was cut while red hot and returned to the furnace, brought to 1450°F for ½ hour and furnace cooled.

Figure 14 shows the section treated as described above. The left hand edge shows the structure next the torch cut. It may be observed that the macrostructure is quite uniform throughout the specimen.

Figure 15 is of the edge next to the torch cut in the specimen that was reheated to 1450°F for ½ hour after cutting while red hot. This structure is good although somewhat coarser than in the interior away from the cut.

Discussion of Methods for Torch Cutting of Forgings

Our own experience, as well as that of various other investigators whom we have queried, has brought out the fact that cracking does sometimes result from the operation of torch cutting steel. The consensus of opinion is that cracking does not occur except in defective or dirty steel. One company that does a great deal of torch cutting finds that cracking takes place only in the billet from the top of the ingot, in which part the majority of the non-metallic inclusions are contained. On this account they do not cut the steel from the top billet and do cut the steel from the remainder of the ingot without difficulty.

Examination of the torch-cut specimens submitted for this investigation has shown that no cracks were present in them. The probability that strains are set up by the process is indicated by the difference in hardness of the original forging and the face that had been cut. It seems reasonable to believe, however, that a forging of good quality steel should have sufficient strength and elasticity to prevent the starting of cracks.

The macrographs used in connection with this paper have shown that the maximum depth of heat effect is ¼" and the machining off of ⅜" of metal would certainly remove all the affected material.

Some strains are probably set up by the torch cutting but it is the writer's belief that where the steel used is of good quality, free from segregation, non-metallic inclusions, and other objectionable irregularities, and forging has been carried out so as to leave good metallographic structure, any strains set up will not be severe enough to cause cracking to result. Steel relatively low in carbon, such as was examined in this investigation, would have sufficient ductility to withstand any strains set up by cutting, and except in cases where defective material is cut, confidence should be had that no cracks will result from the operation.

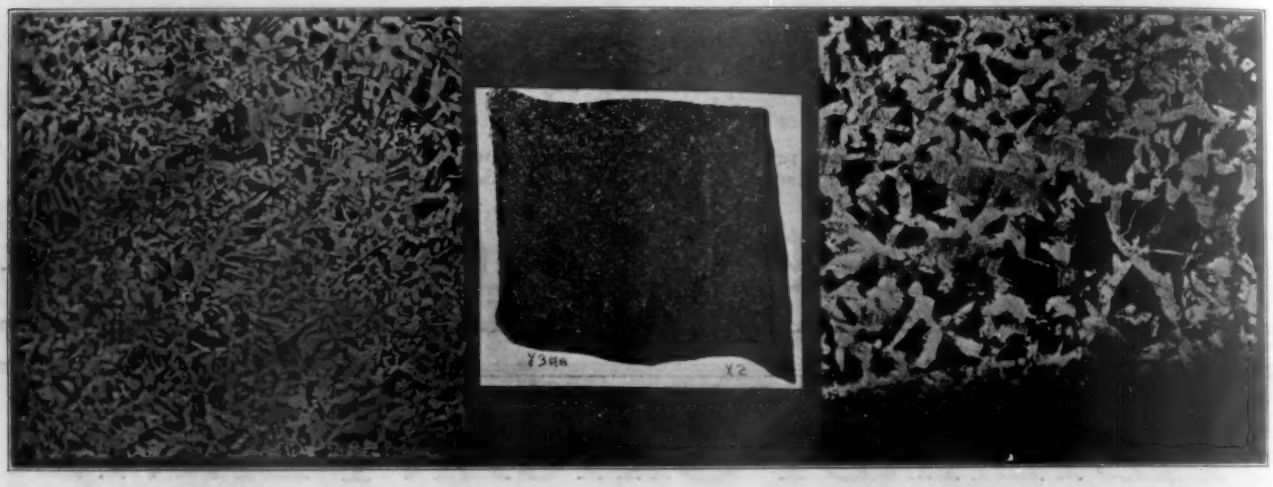

Fig. 13. Fig. 14. Fig. 15.

It is reasonable to assume that the present method of manufacture of important steel forgings, as carried out in the various shops, is a safe method. Examination of forgings has shown that a very appreciable percentage of the possible efficiency of the material is frequently lost by manufacturing methods that are incorrect. The particular forging examined during this investigation was of a very coarse, undesirable structure, due to finishing at too high a temperature.

It seems to be entirely evident that where forgings are manufactured by torch cutting, and then machining off the affected steel or employing proper heat treatment, there results a product which is as satisfactory as one produced by machining alone.

The micrographs that are a part of this paper have shown WELDING ENGINEER 8pt on 10 Mach 4 Mag A Wein 9-6 conclusively that normalizing after torch cutting removes entirely the effects produced in the steel structure.

Not only are these heat effects removed but the condition of the entire forging is much improved by heating to about 1450°F to 1500°F for ½ hour, followed by slow cooling. By slow cooling is meant in the furnace for small pieces or in the open air for heavy sections. In heat treating a large forging sufficient time will of course be required to bring the entire section to a uniform temperature, and on this account it should be held at the desired temperature for a longer time than was necessary for the laboratory treatment shown here.

There is no question but that low temperature annealing at

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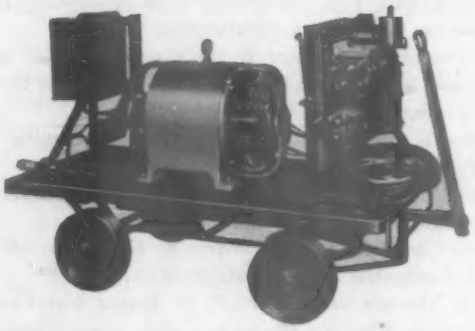

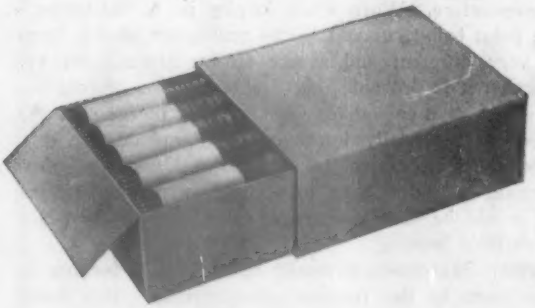

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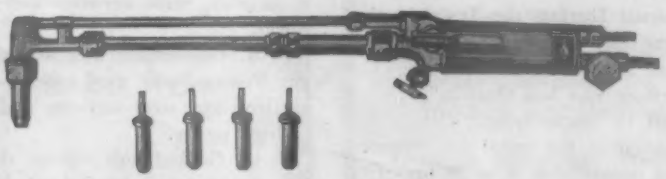

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from 1250°F to 1300°F will relieve all strains due to the heating during torch cutting, but the condition of the entire forging is so much improved by higher temperature normalizing that it is to be preferred.

The experiments carried out in connection with this investigation have shown quite clearly that it is preferable to cut the forging while hot. A curve plotted for the amount of thermal expansion vs. temperature of steel follows quite closely the so-called cooling curve. Except at the critical point where there is a change in the curve, the expansion is proportional to the increase of temperature. When a hot forging is cut the temperatures at the point being cut and in the remainder of the forging are not very different and severe strains are not set up. In this connection it is probable that preheating the forging before cutting would save enough oxygen to offset the cost of the preheating, besides materially improving the product.

It would be more economical to cut the steel while still hot from the forging operation than to allow it to cool and then reheat. This would be satisfactory and would save the expense of an extra furnace heating.

A still further improvement would result if the forging is returned once more to the furnace after cutting. This heating should not be expensive, as the material could be returned to the furnace immediately after completing the cut, when it would contain a large amount of heat and therefore not require a great deal of time or expense to raise to 1450°F. By this treatment the original coarse forging structure would be completely refined and any slight strains remaining in the steel would be relieved. The writer does not feel that the last treatment is always necessary but would be worth while when the best possible product is desired.

Special precautions should be observed where forgings are required to withstand severe stresses in service and where safety of life and property depends upon the quality of the product. For such purposes:

All forgings should be normalized after cutting.

A forging containing more than 0.45% carbon should be preheated before cutting.

These precautions of course are not required for low carbon steels or for parts that are not severely strained in use.

The saving of time and money that attends the use of the oxy-acetylene cutting torch is unquestioned. No machine shop can afford to dispense with this useful tool. The manufacture of a locomotive side rod offers an example of the saving in time that is obtained. The machining of a locomotive side rod forging requires seven days. The same operation is performed by the oxy-acetylene cutting torch in a few hours, followed by less than one day's finish machining. The usual saving of expense in work of this nature is about 70%. This is for the operation itself, but the potential saving is still greater for the torch cutting outfit reduces the number of heavy machines that are required and increases the capacity of those already on hand. The cutting torch then means that a greater output can be obtained with a smaller investment of capital.

Summary of Information Obtained During the Investigation

No cracks were present in the two specimens of torch-cut forgings that were submitted for examination.

The maximum depth of heat effect was less than ¼".

All heating effects are removed by normalizing.

Strains that may have been set up in the metal are removed by low temperature annealing, but normalizing is to be preferred because of resulting improvement in the structure.

As has been shown it is not essential to have the forging hot for cutting, but whenever convenient this method is more desirable.

Improvement results from normalizing after cutting, whether the forging was preheated or not.

The writer recommends that the oxy-acetylene operator cut the forging while hot, return it to the furnace and heat it to 1450°F for ½ hour (or until uniformly heated throughout) and then allow it to cool slowly.

SAFETY MEETING ON WELDING AND CUTTING

The engineering section of the National Safety Council held its second meeting of the year at Detroit, Mich., in co-operation with the Detroit Safety Council on June 12.

In the morning, the subject of safety in welding and cutting was discussed by experts representing the three modern methods: electric, gas and thermit, followed by a practical demonstration of the use of goggles to protect against the injurious visible and invisible rays, and a general discussion in which the industrial safety engineers in the audience had opportunity to secure information on their own particular problems.

The afternoon was devoted to the general topic of industrial sanitation and health work, with particular reference to the prevention of infections from the use of cutting oils.

Following is the program for the Detroit morning meeting held in the Board of Commerce Building:

General Topic—Gas and Electric Welding and Cutting.

Safety in Electric Welding and Cutting.

Safety in Gas Welding and Cutting, by C. F. Worfolk, Michigan State Automobile School, Detroit, Mich.

Safety in Thermit Welding, by C. D. Young, Metal and Thermit Corporation, Chicago, Ill.

Eye and Face Protection for Welders and Cutters (with demonstration of effect of various kinds of glass in cutting down visible and invisible rays), by G. A. Kuechenmeister, Dominion Forge & Stamping Co., Walkerville, Ont.

Round Table Discussion.

INVENTOR OF THERMIT WELDING PROCESS DIES

Prof. Dr. Hans Goldschmidt, inventor of the widely known Thermit Process for welding iron and steel and for producing high grade metals and alloys, also originator of many other scientific inventions, died suddenly in Baden-Baden, Germany, on May 20, 1923, after a stroke.

Prof. Goldschmidt was born in Berlin, Germany, on *January* 18, 1861. His father was the proprietor of chemical works and tin smelters which he had founded in 1847. After having been graduated from the "gymnasium" of Altenburg, Hans Goldschmidt studied chemistry, physics and natural sciences in general at the universities of Berlin, Leipzig, Heidelberg, Strassburg and at the Institute of Technology at Charlottenburg, his principal teachers being A. W. Hoffman, Landolt, Wiedemann, Bunsen, Kundt and Slaby. He received the degree of Ph. D. from the University of Heidelberg in 1886.

In 1887 Prof. Goldschmidt entered the firm of Th. Goldschmidt, Essen Ruhr, Germany, in joint partnership with his brother, Dr. Karl Goldschmidt. The attention of the latter was applied mainly to the business management of the company, while Prof. Hans Goldschmidt devoted himself to scientific research. Under their joint guidance the firm grew to international importance, with agencies and allied companies throughout the world.

Prof. Goldschmidt's most important invention was the Thermit Process, now used extensively all over the world for welding iron and steel sections, and for producing metals and alloys of high purity.

Prof. Goldschmidt visited this country very frequently and was president of the Goldschmidt Thermit Company, now Metal & Thermit Corporation, from 1904 to 1916. Through his death the world loses a chemist of great knowledge and inventive genius.

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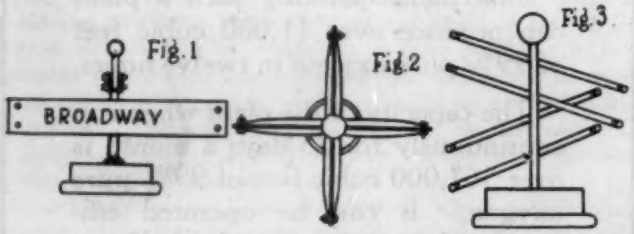
SMALL SHOP CONTRACT WORK

How a Job Welder Reduced the Cost of Making Street Signs on a Production Basis

By Edwin Kilbourn

WE recently were invited to bid upon a contract to furnish approximately 100 street corner sign posts on a local job and by making good use of our welding equipment we were able to secure the work and make a little money during the dull winter season.

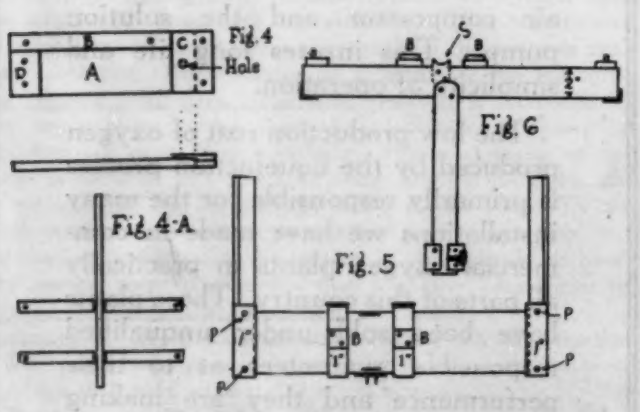
The job consisted of the familiar post of wrought iron pipe surmounted by a suitable fixture upon which was mounted the enameled metal signs. The signs were approximately 19x4½ inches with holes at each corner for attaching them to the supporting fixture, there being four signs mounted on each supporting fixture, faced two at right angles to each other in order that they may be read from either direction of the streets at whose intersection they are placed.



Details of Welded Street Sign.

After figuring the cost of various styles of sign post heads we decided to use one made as shown in Figs. 1, 2 and 3, Fig. 1 showing a view of the completed head with signs attached, Fig. 2 being a top plan view and Fig. 3 showing the completed head before attaching signs.

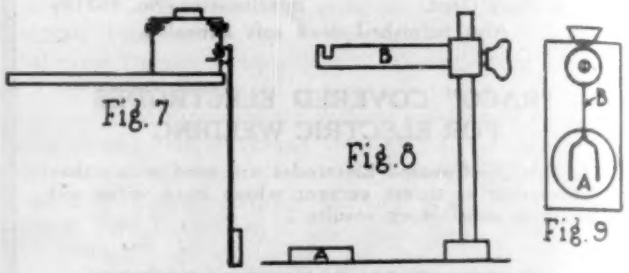
The material used consisted of the following items: Base for



Jig for Holding Parts to be Welded.

attaching to iron pipe post; one 2-inch malleable cap; center upright, ⅝-inch round, mild steel; cross arms, 1¼ inches wide, ⅜ inch thick, mild steel; ball ornament at top, 2-inch diameter cast iron.

The welding room work consisted of the following operations: Eight welds for attaching cross arms to uprights, one weld for attaching ball ornament at top of upright and one braze for attaching malleable iron cap to bottom of upright. The first operation after cutting the stock to size was to provide a means of rapidly jigging the cross arms while welding. This was done by making a simple drilling jig to drill the holes in the outer ends of the cross arms, this jig being constructed as shown in Fig. 4, in which A represents the base made of 3-inch flat mild steel. Along one edge of this was placed the back stop B, a strip of steel ⅞x½ inch. The drilling plate C was placed at one end of the base and elevated from it by means of a steel strip ⅞ inch thick. The drilling plate should be ⅜ inch thick and case hardened for durability. At the opposite end of the jig from the drilling plate was placed the end stop, D, the distance between that and the piece supporting the drilling plate being just sufficient to admit the pieces to be drilled. When the pieces were



Providing a Firm Support for the Welding Operation.

placed in the jig the guide hole in the drilling plate would properly locate the drill to produce the hole in the proper position in the cross arm pieces, in order that when the cross arms were placed in their proper position against the upright for welding the holes in the arms would be in the proper position for attaching the enameled metal signs, as shown in Figs. 1 and 2.

We next devised a jig which would hold these pieces in their proper position while doing the welding. This jig was constructed as follows, the details being shown in Figs. 5, 6 and 7: Made up of four cross members of ⅞x1-inch steel attached to two longitudinal members of ⅞x2-inch steel, the cross members attached by means of short pieces of angle iron welded on their lower sides near the ends, the other portion of the angle bolted to the lengthwise pieces with stove bolts. The two cross members at the ends were provided with pins, P, as shown in Fig. 5, these pins being so located that the holes in the cross members of the sign head would be in their proper position when the welding was completed. The two central cross pieces were provided with locating blocks, B, as shown in Fig. 5 to properly align the inner ends of the cross pieces. The ⅝-inch steel upright was supported for welding by means of the supporting pieces shown in Fig. 6 at S, the layout of the pieces being as shown at Fig. 4-A.

After the first set of arms were welded the piece was again placed in the jig with one of the arms first welded held in the locating arm shown projecting from the bottom of the jig in Figs. 6 and 7. This locating arm had at its lower end a clamp made to hold the arm of the sign head in a position at right angles to its position when welded. This clamp was made of two short pieces of angle iron in one of which was placed a thumb screw for holding the sign post arm in position while welding. After placing the completed portion of the head in the jig as just described it was easy to quickly weld on the second set of arms and know they would be at right angles to the first set. It is also possible in case there are many streets not at right angles at their intersections to vary the angle of the two sets of signs by making the locating arm of Figs. 6 and 7 adjustable and thus bring the signs in position to be readily seen on the street on which they are located.

The two pieces of angle iron shown projecting from the back of the jig in Figs. 5 and 7 are for the purpose of providing a firm support for the jig during the welding.

After the arms were welded it was next necessary to attach the malleable iron 2-inch pipe caps at the bottom of the sign post head. This was done by boring a ⅝-inch hole in the caps, grinding the scale off around the hole and also removing the scale from the lower end of the central stem of the head, then by means of the fixture shown in Figs. 8 and 9 the completed heads and caps were held in proper position to braze them together and make sure they would be in proper alignment when the work was done. This fixture consisted of a base of ¼x3-inch steel to which was attached a locating piece, A, turned just small enough to permit the pipe cap to be dropped over it freely. To the base was also attached the lug which carries the upright piece shown and which carries a supporting arm with a fork at its outer end as shown in Fig. 9, this fork being just wide enough to admit the central stem of the head assembly. The fork has slots as shown in Fig. 8 of the proper width to admit the cross arms.

A thumb screw locked the arm to its proper position on the upright and the use of this fixture permitted us to attach the pipe caps very rapidly. The same fixture was used in holding the ball ornaments in proper position for welding, the balls having had drilled into them a ⅝-inch hole before the welding was commenced, the hole being drilled about ¾ inch deep and the welding being merely a means of easily attaching them permanently to the central stem and much less expensive than threading and screwing the parts together.

None of these fixtures used on this job were at all complicated, made of expensive materials or required particularly fine workmanship in their construction and they merely go to show that many shops could profitably handle occasional contract jobs if the owners will make the best use of their facilities.

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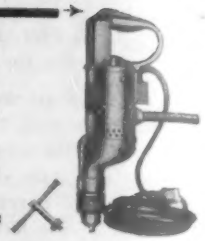

CURRENT WELDING LITERATURE

METALLURGICAL ASPECTS OF WELDING, by Leslie Atchison—A scientific discussion of welding from the special point of view of the metallurgist who has to decide whether or not welding shall be used in the building up of any particular piece of work. It is pointed out that the leading feature in steel welding is that the material is very locally heated for a high temperature, and is cooled very rapidly. The effect of this local heating and rapid cooling upon the properties of steel are considered: first, as they affect the structure of the steel, and second, as they effect its volume. The discussion is illustrated by a series of micro photographs, which show the structural changes brought about by the welding operations.—Acetylene & Welding Journal, London, May.

DEVELOPMENTS IN ARC WELDING, by O. H. Escholz—A review of arc welding activities pointing out some of the developments which are as yet incomplete. It is pointed out that the 100% fusion weld has been achieved in some measure by the arc welded lap joint, using a high welding current. Experinece has also produced welds made with alloy steel electrodes which tests stronger than the plate. Mechanical treatment and heat treatment have also been employed to improve arc deposited metal. Attention is called to the increased penetration obtained with coated electrodes. Further research in this field promises developments such as a better cutting electrode. Possibility of welding with a minimum of preparation, and the possible reduction of overhead welding.—Acetylene & Welding Journal, London, May.

THE OXYGEN-PETROL WELDING AND CUTTING PROCESS—A discussion of the activities of some European manufacturers who are promoting the use of the oxy-benzol welding torch. The discussion criticizes this process as being more expensive, more dangerous, and less efficient than the oxy-acetylene process. Particular attention is directed to the argument that the welding cone of the oxy-benzol flame must, of necessity, be surrounded by an atmosphere containing free water vapor, thus exerting an oxidizing influence over the metal.—Acetylene & Welding Journal, London, May.

FABRICATING STORAGE TANKS BY OXY-ACETYLENE WELDING—How one producer of gasolene storage tanks has speeded up output and increased economy in his plant. It is his practice to have the welding shop work on only one type of tank at a time. This system contributes toward better welding and quicker inspection.—Acetylene Journal, June.

WELDING MONEL METAL—General instructions for welding monel metal, and precautions taken to obtain the best results. Some applications are illustrated.—Acetylene Journal, June.

THE OXY-ACETYLENE PROCESS, by E. H. Smith—A discussion of the nature of the oxy-acetylene flame and the extent of its use in the United States. Some applications of the process which lead to large economies.—Acetylene Journal, June.

PRACTICAL POINTS IN RAILROAD SHOP WELDING, by E. S. Eldridge—Procedure followed in the D. L. & W. shops in making frame welds with the electric arc and with the torch. The use of tobin bronze for supplying missing parts on broken cast iron gears is recommended. A quarter-inch patch is recommended when welding fire box sheets with the electric arc. Engine wheels are to be preheated before welding broken spokes.—American Machinist, June 7th.

ELECTRIC ARC WELDING, by Royal Mattice—Definitions of cast iron, steel, wrought iron, carbon, pig iron and grey cast iron. The effect of stresses and strains which develop in castings. Selection of welding wire for use in welding cast iron. The application of the electric arc to welding steel.—Engineers and Engineering, April.

ARC WELDING AND CUTTING—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently issued special publication No. 1659, in which the subject of electric arc welding and cutting is treated in a thorough and interesting manner. The booklet, which contains numerous illustrations, begins with a chapter on the reasons for organizing and standardizing the welding organization, the training of arc welders and the inspection of metallic electrode arc welds. This is followed by chapters on the principles of arc welding, the physical characteristics of arc metal, the use of the graphite electrode, and cost and application data. Several pages are then devoted to a brief description of Westinghouse arc welding apparatus.

THE OXY-ACETYLENE TORCH IN THE MAKING OF RADIO AERIAL MASTS, by David Baxter—Pointing out that the oxy-acetylene equipped shop is also equipped with a fairly complete manufacturing plant, and that the man who owns and operates a welding and cutting plant is, in reality, a manufacturer, if he takes advantage of his possibilities.—American Blacksmith, May.

RECENT DEVELOPMENTS IN THE ARC WELDING FIELD, by W. L. Warner—Report of the Electric Arc Welding Committee of the American Bureau of Welding, pointing out that constantly increasing applications in both maintenance and manufacturing mark the progress of the welding art.—Railway Electrical Engineer, May.

MAKING WELDED PRESSED STEEL AUTOMOBILE WHEELS—Methods and equipment employed in making automobile and truck wheels by the electric resistance process. It has been found that pressed steel wheels in which the parts are welded together are unusually strong and well balanced. Construction of the wheel, method of holding the spokes while welding, making the spiders, operation of the spot welding machine, butt welding the spiders, spot welding the rims, comparison between welded pressed steel and wood spoke wheels.—Machinery, June.

THE USE OF OXY-ACETYLENE EQUIPMENT IN CITY GAS PLANT, by E. E. Lungren—Describing the effectiveness of the oxy-acetylene welding process in laying cast pipe lines. The elimination of leaks in the lines is the most important consideration in favor of welding, because experience shows that screwed pipe joints will develop leaks while in service. The next important factor is the strengthening of the joints which reduces danger of breakage. More rapid progress can be made in laying welded lines, and a great deal of the welding can be done before the trench is made.—Industrial Gases, London, March.

CAST WELDING ON PIPE LINES, by N. E. Wagner—Methods of organization which have made possible the successful welding of mammoth pipe installation.—Industrial Gases, London, March.

BLOWPIPE USES IN A PACKING PLANT—Illustrating the value of a central welding shop in a large manufacturing organization. In one plant it serves each of the many departments and devisions as a repair shop for almost any kind of tool or metal equipment used. When breaks occur, the welding shop is always consulted before a new part is requisitioned.—Oxy-Acetylene Tips, May.

WELDING MALLEABLE IRON, by M. LeGrix—The structure of malleable castings and the changes which they undergo instantaneously at high temperatures. It is noted that as soon as malleable castings are raised to a temperature of 1,500 degrees, the carbon which it contains, either in the form of graphite as in the better grade of castings, or in the combined form as in European castings, goes into combination again with the iron and produces an alloy which has none of the qualities desired in malleable pieces. The obvious conclusion is that malleable castings cannot be welded without making an important and undesirable change in the structure.—Revue de La Soudure Autogene, Paris, April.

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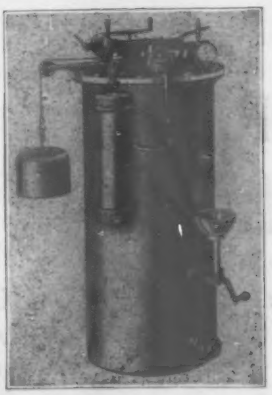

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(Allowance on acetylene tanks)

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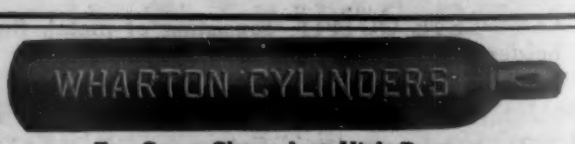

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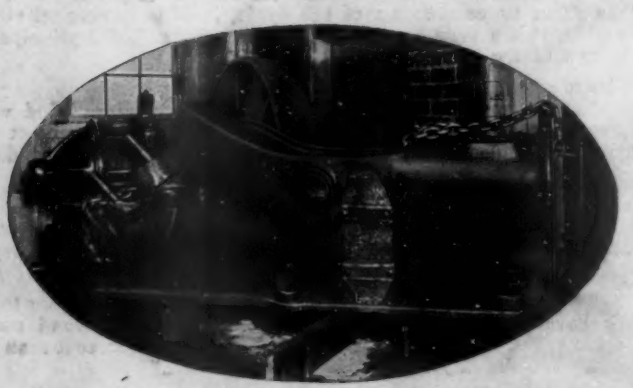

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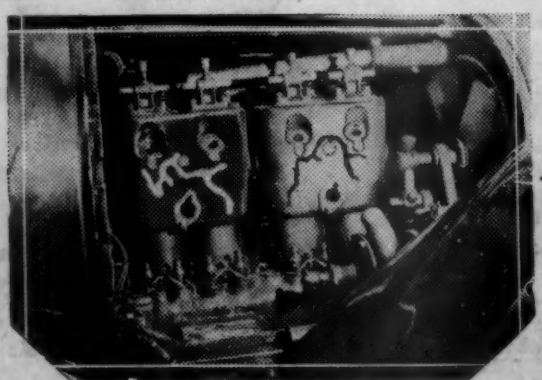

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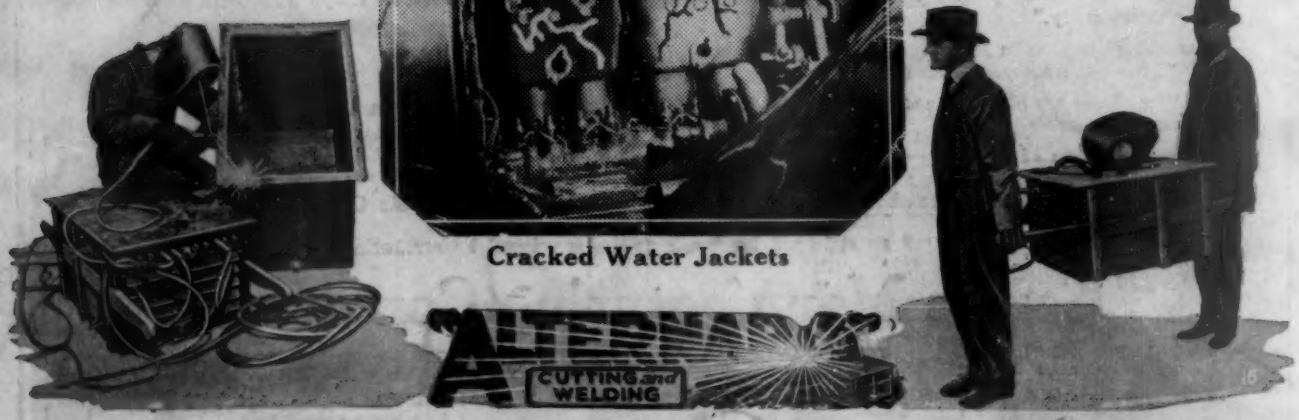

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